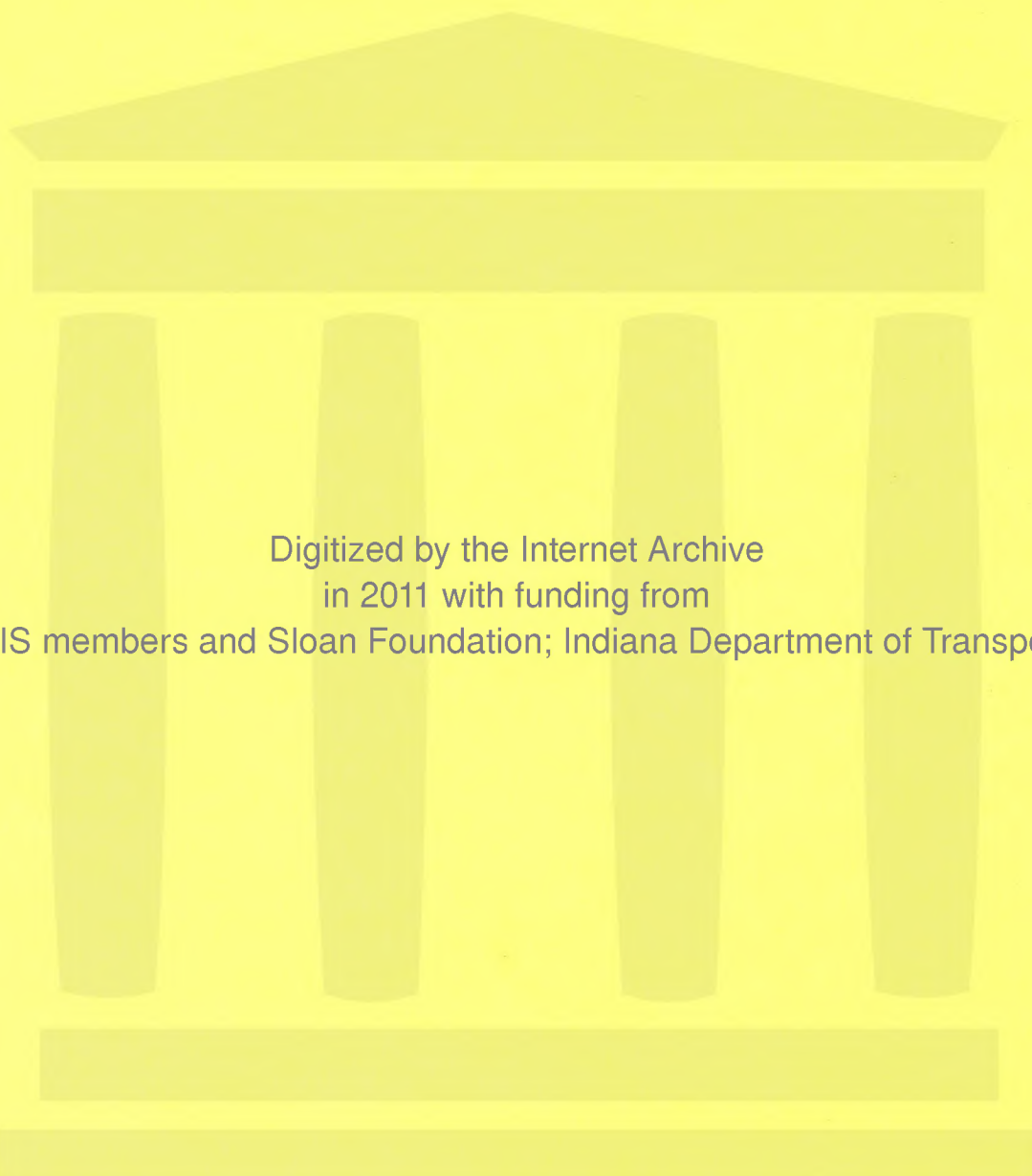# SCHOOL OF CIVIL ENGINEERING

JOINT HIGHWAY RESEARCH PROJECT

JHRP-77-20

AN INVESTIGATION OF THE FINAL CONSTRUCTION CONTRACT PAYMENT PROCEDURE FOR THE INDIANA STATE HIGHWAY COMMISSION

David L. Mays

PURDUE UNIVERSITY
INDIANA STATE HIGHWAY COMMISSION

Final Report

AN INVESTIGATION OF THE FINAL CONSTRUCTION CONTRACT
PAYMENT PROCEDURE FOR THE INDIANA STATE HIGHWAY COMMISSION

TO: J. F. McLaughlin, Director   November 8, 1977
     Joint Highway Research Project
                                         Project: C-36-67I
FROM: H. L. Michael, Associate Director
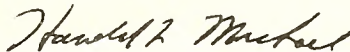   Joint Highway Research Project   File: 9-11-9

     Attached is the Final Report on the approved JHRP Study titled "An Investigation of the Final Construction Contract Payment Procedure for the Indiana State Highway Commission". The title of the Report is the same. Mr. David L. Mays, Graduate Instructor in Research on our staff, has authored the report and conducted the Study under the direction of Professor Donn Hancher.

     The Study objectives of determining the existence of any problems with the procedures and the causes and possible remedies of any problems were achieved. A number of recommendations are included which should be beneficial to ISHC and the State of Indiana. One of these benefits should be a decrease in interest penalties.

     The findings have been presented to the management of the ISHC Construction Division for discussion prior to finalization of this report. Comments received were considered in preparation of this final document.

                                    Respectfully submitted,

                                    Harold L. Michael
                                    Associate Director

HLM:ms

cc: A. G. Altschaeffl   G. K. Hallock   C. F. Scholer
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Final Report

AN INVESTIGATION OF THE FINAL CONSTRUCTION CONTRACT
PAYMENT PROCEDURE FOR THE INDIANA STATE HIGHWAY COMMISSION

by

David Lynn Mays
Graduate Instructor in Research

Joint Highway Research Project

Project No.: C-36-67I

File No.: 9-11-9

Prepared as Part of an Investigation

Conducted by

Joint Highway Research Project
Engineering Experiment Station
Purdue University

in cooperation with the

Indiana State Highway Commission

Purdue University
West Lafayette, Indiana
November 8, 1977

ACKNOWLEDGMENTS

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ABSTRACT

Mays, David Lynn. MSCE, Purdue University, December 1977. An
Investigation of the Final Construction Contract Payment Procedure
for the Indiana State Highway Commission. Major Professor: Dr. Donn
E. Hancher.

Prior to March 1972, several contractors who performed highway
related construction work for the State of Indiana complained about
the State's slowness in making final retainage payments. These com-
plaints resulted in a law being passed by the Indiana General Assembly
which required the State of Indiana to pay an interest penalty to
the contractor if the final payment was not made within 180 days
of contract acceptance. Indiana State Highway Commission (ISHC)
officials believed that this law would benefit the contractor through
faster retainage payments, and at the same time motivate its project
engineers to submit all of the required paperwork for their com-
pleted projects so that this 180 day target date could be met.
However, it was quickly discovered that this law did not accomplish
these objectives. In every year since interest penalties began
occurring, the total amount of interest penalties paid to the con-
tractor has increased. Therefore, ISHC officials felt that research
was needed in order to determine how severe the interest penalty
problem had become and why the interest penalties continue to occur.
The ISHC officials also suggested that the Indiana State Highway
Commission 1970 Construction Record Guide for Road, Bridge,

Maintenance, and Traffic Contracts might be a cause of interest penalties in that its up-to-dateness and clarity are sometimes questioned.

In order to answer these questions, the researchers first had to determine the components of the final construction contract payment procedure and who participated in each. This was accomplished by interviewing three types of ISHC personnel-- District Review Officers, project engineers, and personnel at the Division of Materials and Tests. Each group provided suggestions on how to improve the procedure and expressed opinions on why the present problems exist. The use of the Construction Record was also investigated in the interviews with District Review Officers and project engineers. Finally, the severity of the interest penalty problem was determined by a computer analysis of contract data from 1972 through August 31, 1977.

The research showed that the interest penalty problem is caused primarily by the project engineers and the Division of Materials and Tests' personnel. The project engineers have been turning in the required documentation (the Construction Record) late in the 180 day time period which gives the members of the later components of the procedure less time to complete their duties. The Division of Materials and Tests has had trouble issuing its material certification within the 180 day limit due to organizational problems. The computer analysis showed that interest penalties steadily climbed from $0.00 in 1972 to a projected $43,789.86 in 1977.

Finally, the research produced several recommendations to
improve the final construction contract payment procedure and thereby
decrease interest penalties. Improvements to the Indiana State
Highway Commission 1970 Construction Record Guide for Road, Bridge,
Maintenance, and Traffic Contracts are also proposed as a result
of the research.

CHAPTER 1

INTRODUCTION

From the contractor's point of view, the most important aspect
of a construction job is being paid what is due him by the owner.
Prior to March 1972, several of the contractors in Indiana who per-
formed work for the State felt that the State was much too slow on
the final retainage payment. Their opinions prompted the Indiana
legislature to pass a law requiring the State to pay the contractor
a penalty if final retainage payment was not carried out within a
certain period of time after contract acceptance. In the years fol-
lowing the enactment of this law, State highway officials have noticed
that they are still having trouble paying the contracts on time and
this problem has gotten worse each of the last three years in terms
of total penalty dollars. It was then decided that a review of the
final construction contract payment procedure was needed in order to
point out those areas which are causing the penalty payment problems.
Therefore, it is the purpose of this paper to investigate the present
contract payment procedure and to propose to the Indiana State High-
way Commission changes in the procedure that will increase its ef-
ficiency, along with decreasing the amount of money that the State
has to pay to contractors each year in penalties for late final
retainage payments.

1.1 Justification for the Study

An underlying purpose of every local, state, and national governmental agency is to perform its assigned functions at the lowest possible price while at the same time getting the highest quality work possible. The Indiana State Highway Commission strives to accomplish the goal behind this policy but it sometimes runs into problem areas. At present, the final construction contract payment procedure is such a problem area. To justify this statement, a short history of the problem will be presented which should help to prove the need for a study of this aspect of the Indiana State Highway Commission's activities.

The State of Indiana utilizes the Unit Price Contract system for most of its highway work. This system is excellent for both heavy construction and highway construction because of its flexibility. In highway construction, it is very difficult to determine in advance the exact quantities of work to be accomplished by the contract, such as the amount of excavation or fill required. Unexpected situations can develop throughout a project that can change the estimated quantities. The Unit Price Contract centers around these estimated quantities. The owner of the project (the State of Indiana in our case) makes an estimate of the quantities of work for each activity or work item of a given job. These estimates are in terms of units of work which correspond to the type of activity, such as cubic yards for backfill. The contractors who desire to perform the work for the State of Indiana then submit a bid in terms of a price per unit of work. This unit price includes the estimated costs of the

material, labor, and equipment needed for the activity plus the profit

and overhead for the contractor. This way of contracting in terms of

units of work allows for easy calculation of additions to or subtractions

from the estimated quantity of work for each job activity.

The overall Unit Price Contract system for the State of Indiana

follows a certain procedure. After the bids have been received from

the contractors, the unit prices of each bid are checked by a computer

for gross variation from the norm and unbalancing of the bid. The

contract is awarded to the lowest qualified bidder. Work begins

and as it progresses, the contractor is entitled to periodic payments

for work already completed. The project engineer of the contract

estimates how many units of each work item have been completed by

the contractor during the payment period. These quantities are

multiplied by the unit price of each and are summed to arrive at

the allowable progress payment. However, a portion of this progress

payment, usually 5-10 per cent, is retained by the State of Indiana to

protect it from poor work, contract violations by the contractor,

minor claims for materials, and other contract related problems.

This progress payment procedure is repeated throughout the duration

of the project.

When the contractor completes his contractual work and an

Indiana State Highway Commission official gives it a favorable in-

spection, the contractor is relieved of further maintenance and the

project engineer is required to prepare a final estimate of both

quantities and costs for the project. The State of Indiana then

follows its final construction contract payment procedure to determine

the final dollar amount due the contractor, including the money
retained during each progress payment period. This procedure will be
discussed later in detail but it will suffice to say here that it
includes the checking by the District Review Officer of the project
documents as computed and compiled by the project engineer, material
certifications for all materials required by the contract by both
the District Office Materials' Laboratory and the Division of Materials
and Tests, and the contractor's agreement that the final quantities
are what he put in place. This final dollar amount due the contractor
can change from that expected based on the initial contract amount.
The final amount the contractor receives can decrease due to liq-
uidated damages where a contractor completes the contract late, actual
quantities in place being lower than those originally estimated, or
mistakes in the State's favor on prior progress payments. Conversely,
the final amount the contractor receives can be an increase over
what was originally estimated due to actual quantities in place being
higher than originally estimated, extra work items, mistakes in the
contractor's favor on prior progress payments, or penalties levied
against the State because it did not complete its final construction
contract payment procedure on time. This last item provides the
basis for this study.

Prior to March 1972, several contractors who performed work for
the State complained that it was taking an unreasonable and costly
length of time for them to receive their final payment from the
State of Indiana for a contract including the money retained. This
prompted the 1972 Session of the Indiana General Assembly to change

the statutes existing at that time pertaining to the final contract
payment on highway related construction contracts performed in Indiana.
This new law is found in the Transportation and Public Utilities
division of the statutes (8-13-5) and the pertinent quote is in
Chapter 5, Section 7 and is as follows:

"Each contract entered into pursuant to the provisions of this
chapter shall provide for final payment within one hundred
eighty (180) days after acceptance of the project; provided
that final payment shall not be so made as to any amount which
is in dispute or the subject of a pending claim; and provided
further that final payment shall be so made as to that portion
of a contract or those amounts which are not in dispute or the
subject of a pending claim, and such partial payment shall not
constitute any bar, admission, estoppel or have any other effect
as to those payments in dispute or the subject of a pending
claim. For each day after one hundred eighty (180) days, or
thirty (30) days after settlement of a claim, the commission
shall pay to the contractor a penalty for late payment of money
due to the contractor. This penalty shall be computed at the
rate of interest of six per cent (6%) per annum on the unpaid
balance."

This change in statutes also specifies that this penalty clause
is applicable to all highway related construction contracts for which
bids were received by the State of Indiana on or after March 1, 1972.

On August 10, 1972, N. W. Steinkamp, the Chief Highway Engineer
for the State of Indiana at the time, issued General Letter No. 2-73
which contained a supplemental specification for contracts which
discusses the new statute and points out the beginning and ending
days of this contract payment procedure period in order to compute
possible penalties. This specification is stated as follows:

"Except as otherwise provided herein, final payment will be
made to the contractor within 180 days after acceptance of the
project. Acceptance shall be considered as the date the con-
tractor is relieved of further maintenance as provided in 107.16
and set out in the final acceptance letter.

If final payment is not made within 180 days of final acceptance, the contractor will be paid interest in the amount of 6% per annum on the unpaid balance or retainage, subject to the following conditions:

The final date for computation of interest will be the date that the final estimate is prepared in the Central Office and mailed to the contractor for his signature.

Interest will not be paid for those days that delay in payment of the final estimate is not directly attributable to the State. Included in this category, but not limited thereto, is the elapsed time used by the contractor to review and approve the final pay quantities, proof of payment of railroad indebtedness, delinquent or supplemental payrolls or material records, or any other reason that is controlling to the final payment and beyond control of the engineer.

Funds retained for claims, or resulting from litigation, or amounts in dispute will not be eligible for payment of interest until 30 days after settlement."

The new statute quoted previously was intended to benefit both the contractors and the State of Indiana. By having this type of law, the contractor is assured either of receiving the final amount due him within 180 days of contract acceptance or of acquiring a larger dollar amount after the 180 day deadline due to an interest penalty having to be paid by the State of Indiana. The State of Indiana is benefited in that its personnel know that they have only 180 days to complete the final construction contract payment procedure without penalty. This type of regimen provides for stricter compliance with the law since a disregard for the time limit would cause an unanticipated outlay of funds by the State.

However, it was discovered that the existence of this new statute did not compel the State of Indiana to pay the final amount due the contractor within 180 days of contract acceptance on all of its construction contracts. In fact, contract data shows that the State

of Indiana is getting worse in this respect each year. This can

be seen on Table 1 shown below:

TABLE 1

CONTRACT DATA COMPARISON

Year	Total Penalty Amount Paid During the Year	Percentage of Contracts in Which Penalties Were Paid
1974	$ 1,327.22	1%
1975	$17,417.43	14%
1976	$32,272.57	21%

It can easily be seen that both sets of data are increasing, even

though a law is in effect that tries to prevent this.

Therefore, Indiana State Highway Commission officials realized

that they still have a problem with the final construction contract

payment procedure. This topic surfaced when an advisory committee

of both Indiana State Highway Commission officials and Purdue Univer-

sity Civil Engineering personnel met in the Fall of 1976 to discuss

possible research topics. It was felt that due to the illustra-

ted data, it would be worth the time and money required to investigate

the present construction contract payment procedure and to determine

possible problem areas and their solutions. The goal of the State

of Indiana is to pay all of its construction contracts within the

180 day allotted time period. It is hoped that through the con-

struction contract payment procedure study of which this paper is

a summary, this goal will be closer to realization.

1.2 Objectives of the Study

There are three primary objectives to this investigation. All relate to one another and lead to the same result-- a more efficient final construction contract payment procedure. Each will be discussed separately and indications given of its importance to this study.

The first objective is that of investigating the actual final construction contract payment procedure and how it is carried out. How this procedure is supposed to be accomplished will be discussed in Chapter 2 of this paper. However, it should be pointed out that the present procedure makes strong use of the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts. Indiana State Highway Commission officials have expressed the opinion that the way the present construction contract payment procedure is being carried out by State personnel might be causing penalties having to be paid on construction contracts. They feel that there could be inefficiencies in the present system, which when discovered and alleviated, could enable the State of Indiana to complete a higher percentage of its final construction contract payments within the 180 day time limit. This would then result in a smaller total penalty amount being paid by the State of Indiana to contractors during the year. Therefore, a thorough investigation of this final construction contract payment procedure is of utmost importance to this study.

The second objective of this investigation is a complete review of the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts. As can

be seen from the title, it has been seven years since this publication
has been updated. This guide is used by the project engineer of
each contract to complete the paperwork required for the highway
related construction project. It offers to the project engineer a
format of computing final pay quantities for each project work item.
As was expressed with the final construction contract payment procedure,
Indiana State Highway Commission officials feel that this guide
could be inhibiting the payment procedure process and could in turn
be a primary reason for interest penalties having to be paid to the
contractors. Complaints have been expressed also by both project
engineers and District Review Officers with respect to inefficiencies
caused by this book. Therefore, the content of this guide will be
completely researched and will be discussed at length with Indiana
State Highway Commission officials around the State of Indiana.

The third and final objective of this study is that of completing
a data analysis of all highway related construction contract data
since the interest penalty statute was enacted by the Indiana General
Assembly in 1972. Contract data is available from the Indiana State
Highway Commission Indianapolis office on computer printouts beginning
in 1972. Contract data is updated each month as to those contracts
still in progress at the end of the month along with those contracts
that were completed during the month. A sample of the type of contract
data available from the State of Indiana can be seen in the Computer
Program Development section (7.1) of this paper. The objective of
the data analysis is to point out the problem areas of the final
construction contract payment procedure with respect to contract type,

project engineer type, geographic district, and the reasons for the interest penalties. From the compiled data, several graphs and tables will be made to show interest penalty trends. An example of this has already been seen in Table 1 in the Justification for the Study section (1.1) of this paper. This table pointed out that the penalty situation has gotten worse in each of the last three years in the State of Indiana. Therefore, it is hoped that this data analysis will illustrate that there is a construction contract payment procedure problem and where the problem is most critical. Finally, it should be pointed out that this data analysis will include all contract data from 1972 through August 31, 1977. Since this paper will be completed by late November 1977, the data will be stopped at this August date to enable the researchers to complete a thorough analysis of the data. However, the researchers will point out anticipated 1977 contract data amounts based on the trends shown during the first eight months of the year.

The three objectives of this study have been thoroughly explained in the preceding paragraphs. How they will be carried out and accomplished will be explained in the next section of this paper.

1.3 Method of Completing the Research

The final construction contract payment procedure is a type of construction engineering management technique. A process has been devised in which project engineers complete the required paperwork for a highway related construction contract. This paperwork, also known as the Construction Record, is checked by the district office, and then final payment is made to the contractor of the project.

The State of Indiana has 180 days to complete this process after project acceptance. Therefore, it was felt that in order to complete the analysis of the construction contract payment procedure, it would be best to interview those engineering managers directly involved with the process. There are several types of engineering managers associated with the procedure and the method of extracting the required information from each of them will be discussed separately.

The first type of engineering manager involved with the final construction contract payment procedure to be interviewed was the District Review Officer. There are six geographic highway districts which comprise the State of Indiana and each has a District Review Officer. The main jobs of the District Review Officer are to receive a contract's Construction Record from the project engineer, check its content for precise final work item quantities, issue final work item quantity summary sheets to receive the required material certifications, receive the contractor's approval of the final quantities, and issue the completed Construction Record to the Central Office for final payment to the contractor. As can be seen from his job duties, the District Review Officer is one of the key men in the final construction contract payment procedure. Therefore, the researchers traveled to all of the six geographic districts of the State of Indiana, talked individually with the District Review Officers and asked of each the following questions:

a) How is the final construction contract payment procedure carried out in your district?

b) In your opinion, what are the main reasons for interest penalties?

c) Do you notice any differences between the Construction

Records of the city, county, and state project engineers?

d) Do you have enough personnel to complete your required duties?

e) What are your recommendations on improving the final con-

struction contract payment procedure?

f) What do you think about the Construction Record Guide?

    1) Unnecessary sections?

    2) Repetition?

    3) Needed sections?

    4) Any other changes that could improve the guide?

    5) Unnecessary forms?

g) Do you initiate retainage reductions?

The researcher stressed to each District Review Officer that his

opinions would be held in confidence, and that his frankness would

lead to a better final construction contract payment procedure.

The six interviews with the individual District Review

Officers provided a lot of valuable information and rec-

ommendations for improvement of the final construction contract

payment procedure. Also, the District Review Officers provided

excellent suggestions on improving the Indiana State Highway Commission

1970 Construction Record Guide for Road, Bridge, Maintenance, and

Traffic Contracts. The opinions of the District Review Officers

on both the final construction contract payment procedure and the

Construction Record Guide will be expressed in Chapter 3 of this paper.

The second type of Indiana State Highway Commission personnel

interviewed about both the final construction contract payment

procedure and the Construction Record Guide was the project engineer

of a contract. The project engineer prepares what is called the

Construction Record for a project. In this document, he computes the

in-place quantities of all of the work items which make up a contract.

He accounts for any Change Orders to the contract or any Extra Work

Agreements. He then turns the completed Construction Record over

to the District Review Officer. Therefore, it can be said that the

project engineer completes the first step of the final construction

contract payment procedure.

An underlying reason for interviewing the project engineers

was that Indiana State Highway Commission officials felt that they

could be part of the problem in not meeting the 180 day deadline.

No engineer likes the paperwork required for a job; so it was the

feeling of the researchers that by asking various project engineers

their opinions of both the final construction contract payment pro-

cedure and the Indiana State Highway Commission 1970 Construction

Record Guide for Road, Bridge, Maintenance, and Traffic Contracts,

ideas could be obtained that could improve the efficiency of both.

The project engineers and the District Review Officers work with both

of these topics every day and their opinions can far outweigh those

of the researchers who see these topics for a much shorter period

of time.

The actual interviews of the project engineers were carried

out in the Crawfordsville District of Indiana. The researchers

traveled to various areas around the district, stopped at a number

of jobs, and talked with several project engineers. The researchers

asked questions of the project engineers similar to the listing

shown for the District Review Officers. The opinions and recommendations

expressed by the project engineers can be found in Chapter 4 of

this paper.

The third type of personnel interviewed about the final con-

struction contract payment procedure was a few of the men who work

at the Division of Materials and Tests in Indianapolis. This labo-

ratory issues material certifications. From both the initial analysis

of the contract data and opinions expressed by Indiana State Highway

Commission officials, it quickly surfaced that this laboratory

could be a cause of some of the interest penalties. Therefore, the

researcher traveled to Indianapolis to discuss with the laboratory

personnel how they carry out their aspect of the final construction

contract payment procedure. He asked how they issue a material

certification and what type of organizational structure the labo-

ratory follows. The results of this interview can be found in

Chapter 5 of this paper.

Finally, the researchers used a computer to accomplish their

data analysis of past and present highway related construction con-

tract data. How the computer program was written and what it en-

compasses can be seen in the Computer Program Development section (7.1)

of this paper. The actual data compiled and summarized is found

in Chapter 7, the Data Analysis chapter.

CHAPTER 2

AN EXPLANATION OF THE FINAL CONSTRUCTION CONTRACT PAYMENT PROCEDURE

Since this investigation is centered around the final construc-
tion contract payment procedure, an explanation of the process is
in order. It should be pointed out that this elucidation of the
procedure will list how it is theoretically supposed to be carried
out. It was quickly discovered by the researcher in his talks with
the District Review Officers that they do not all precisely follow
each of the steps about to be shown. Their reasons for variances
from the process will be explained in Chapter 3 of this paper, the
Results of Interviews with the District Review Officers chapter.

It is felt by the researchers that the best way to illustrate
the procedure is to list the steps that are followed to complete
the process. Each step will be comprised of what is done in it and
who participates in each component of the procedure. The final
construction contract payment procedure is as follows:

1) COMPLETION OF MATERIAL RECORDS (IT 611)- These forms are

prepared monthly throughout the project by the contractor.

They are a record of all of the materials received during

the month that are included in the finished project. The

contractor submits the IT 611's to the project engineer

who in turn checks them both for proper quantities and for

representation of all items received on the job during the

month. This is necessary because the contractor sometimes computes quantities incorrectly or omits work items. After the Material Record has been checked each month, the project engineer forwards it to his District Review Officer who in turn forwards copies to the District Office Materials' Laboratory and the Division of Materials and Tests.

2) COMPLETION OF THE CONSTRUCTION RECORD- This document is prepared by the project engineer and is submitted to the District Office. For each work item of the contract, the project engineer compares the plan quantity with the quantity in place. Overruns and underruns are noted. This data provides the necessary information for the State of Indiana to make contract price adjustments to the originally estimated total contract price.

3) DISTRIBUTION OF PRELIMINARY WORK ITEM QUANTITIES- After the Construction Record is received in the District Office, the District Review Officer transfers the as-built work item quantities onto an IC 642 form which is entitled Comparison of Estimates- Original and Final. He issues this form to both the District Office Materials' Laboratory and the Division of Materials and Tests as preliminary contract quantities. They in turn begin checking to see if the quantities of work items shown on the Material Records sent to them previously are equal to or greater than the quantities shown on the IC 642.

4) <u>CHECKING OF THE CONSTRUCTION RECORD IN THE DISTRICT OFFICE-</u>
After sending out the preliminary quantities, the District
Review Officer and his subordinates begin a thorough check
of the Construction Record. They check to make sure that the
project engineer has made no mathematical errors in his
work item quantity calculations, that all of the work items
in the contract show up in the Construction Record, that the
field books are cross referenced with the Construction
Record, and that all of the proper forms required by the
<u>Construction Record Guide</u> are included in the project en-
gineer's Construction Record.

5) <u>DISTRIBUTION OF THE FINAL WORK ITEM QUANTITIES-</u> After the
Construction Record has been checked in the District Office,
the District Review Officer then issues an IC 642 form
containing final work item quantities to both the District
Office Materials' Laboratory and the Division of Materials
and Tests. They had begun their comparison of in-place
quantities with Material Record quantities using the pre-
liminary IC 642; now, they can complete the procedure using
the final IC 642.

6) <u>ISSUANCE OF THE DISTRICT OFFICE MATERIAL CERTIFICATION-</u> After
it has determined that the in-place work item quantities
agree with the Material Record quantities, the District
Office Materials' Laboratory issues a District Office
Material Certification to the Division of Materials and
Tests. The District Office is notified of this also.

7) ISSUANCE OF THE DIVISION OF MATERIALS AND TESTS CERTIFICATION-
After it has satisfactorily completed its check of
final IC 642 quantities with Material Record quantities,
have made the determination that the required number of
sample tests have been taken, and have been notified that
the District Office Materials' Laboratory has issued a
material certification, the Division of Materials and Tests
issues its certification and notifies the District Office
of this fact.

8) ISSUANCE OF THE M-39, THE CONTRACTOR'S INSPECTION OF THE
FINAL CONSTRUCTION RECORD REPORT- After both of the material
certifications have been received in the District Office,
the District Office issues a final quantity IC 642 and the
M-39 form to the contractor. This is done so the contractor
can check to see if he agrees with the in-place quantities
along with the final contract total dollar amount. If the
contractor agrees with the work item quantities and the total
contract amount, he signs the M-39 and returns it to the
District Office. If he does not agree, negotiations on
the dispute begin.

9) TRANSMITTAL OF THE CONSTRUCTION RECORD TO THE CENTRAL OFFICE-
When the M-39 is received signed from the contractor, the
complete Construction Record is sent to the Central Office
for additional checking and payment approval.

10) PAYMENT TO THE CONTRACTOR- After receiving the Construction
Record from the District Office, personnel in the Central

Office check it and if it meets their approval, a check is

issued to the contractor for the final amount of money

due him.

The final construction contract payment procedure is illustrated

in the flowchart shown in Figure 1. The blocks signify persons or

places involved in the procedure while the arrows indicate activities

between them. The numbers along the arrows are explained on page 21.

It should be kept in mind that the procedure explained and shown

in the flowchart form is the theoretical procedure. The variations

to the final construction contract payment procedure as expressed

by the District Review Officers will be shown in the Results of

Interviews with the District Review Officers chapter of this

paper (Chapter 3).

Refer to the next page for the explanatory
notes on the numbers beside the arrows.
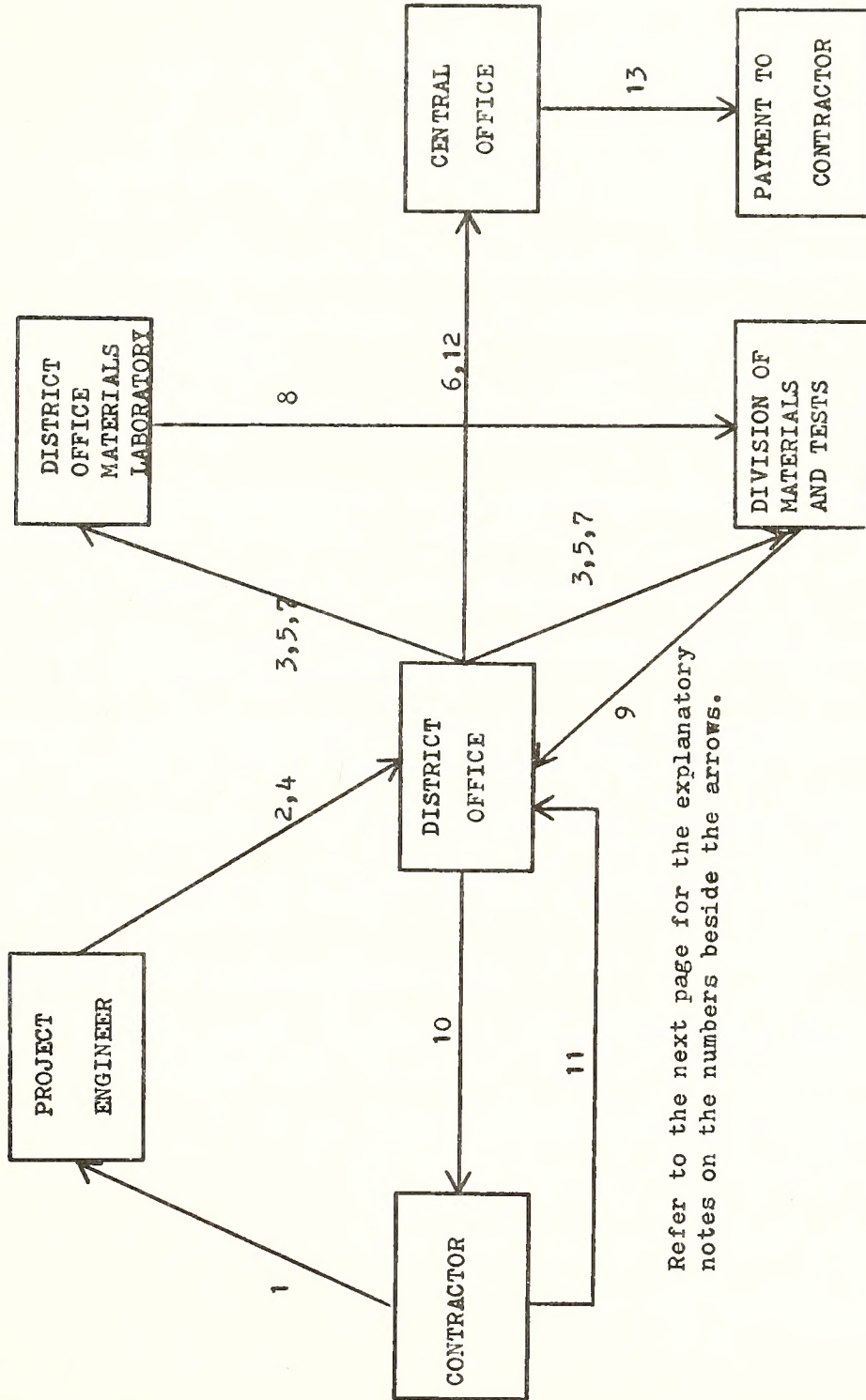
Figure 1

FINAL CONSTRUCTION CONTRACT PAYMENT PROCEDURE FLOWCHART

EXPLANATORY NOTES FOR THE FINAL CONSTRUCTION CONTRACT

PAYMENT PROCEDURE FLOWCHART

1) Contractor completes and issues a Material Record form (IT 611) each month.

2) Project engineer sends in the checked IT 611 each month.

3) The district office passes on the IT 611 each month to the testing laboratories.

4) Project engineer completes and sends in the Final Construction Record.

5) District office issues preliminary work item quantities on an IC 642 form to the testing laboratories.

6) District office checks the Final Construction Record.

7) District office issues final work item quantities on an IC 642 form to the testing laboratories.

8) District Office Material's Laboratory issues their materials' certification to the Division of Materials and Tests.

9) Division of Materials and Tests issues their materials' certification.

10) District office sends a final quantity IC 642 and an M-39 form to the contractor.

11) Contractor sends in the signed M-39.

12) District office sends the completed Final Construction Record to the Central Office.

13) Central Office checks the Final Construction Record and issues the final payment to the contractor.

Figure 1, cont.

CHAPTER 3

RESULTS OF INTERVIEWS WITH THE DISTRICT REVIEW OFFICERS

The researchers traveled to all six State of Indiana highway
districts and spoke with the District Review Officer in each district.
This man is responsible for reviewing a contract's Construction
Record received from the project engineer, checking its content for
precise work item quantities, issuing final work item quantity
summary sheets to receive the required material certifications,
receiving the contractor's approval of the final quantities, and
issuing the completed Construction Record to the Central Office for
final payment to the contractor. Each District Review Officer was
asked a set of questions which were listed in Section 1.3 of this
paper. The results of these interviews **will** be discussed in the
following sections, each of which pertains to a certain topic of
discussion.

3.1 Final Construction Contract Payment Procedure Flow in the Districts

A discussion of how the final construction contract payment
procedure is theoretically supposed to be carried out was made in
Chapter 2 of this paper. This procedure was condensed into the
flowchart seen in Figure 1 on page 20. Each of the District
Review Officers was asked if he followed the theoretical procedure and
it was found that not all of them did. In fact, only one of the

districts out of six follows the final construction contract payment
procedure step by step. There are two primary deviations to the
procedure with three out of six of the districts practicing the first
one and two out of six practicing the second. The first deals with
preliminary and final quantities on the IC 642 forms. The procedure
calls for the District Review Officer to transfer the work item
quantities calculated by the project engineer onto an IC 642 and to
send these preliminary quantities to both material certification
laboratories so they can begin their certifications. The District
Review Officers are then supposed to check the Construction Record
and the work item quantities within it. They then issue final quantity
IC 642's to the laboratories. It was discovered and the researchers
concur in this practice that the majority of the districts do not
issue preliminary quantities to the certification laboratories. The
District Review Officers in these districts stated that it usually
only takes them a few days to check a Construction Record. Therefore,
they feel that it is unnecessary to issue preliminary quantity IC 642's
to the laboratories and then three or four days later issue final
quantity IC 642's. However, the districts do realize that if a work
item quantity is in dispute or if it takes a long time to check
(such as dirt cut and fill), they will issue preliminary quantities
to the certification labs in this case.

The second procedural nonconformance deals with the issuance
of the M-39 form which is the Contractor's Inspection of the Final
Construction Record Report. The theoretical procedure calls for
issuance of the form to the contractor after the District Review

Officer receives both material certifications. However, due to past problems dealing with long waits for material certifications, two of the districts send out an M-39 when they have determined what the final work item quantities will be. The researchers feel that this is a bad practice and that these two districts should revert to the specified procedure. Many times, items are left off Material Record forms by the contractors. This changes work item quantities which then change the contract price shown on the M-39. If this happens, a new M-39 has to be sent to the contractor. Therefore, waiting for both material certifications before issuing the M-39 seems to be the most feasible thing to do. It should also be kept in mind that the time spent waiting for the M-39 form to be returned from the contractor is not charged towards the State's 180 day payment period.

3.2 Causes of Interest Penalties

All of the six District Review Officers were asked what they thought were the main reasons for interest penalties and each gave essentially the same answers. The two reasons mentioned by all were project engineer paperwork problems, and late issuance of the Division of Materials and Tests certification. As will be seen in Chapter 7, the Data Analysis chapter, the contractual data correlates with the opinions of the District Review Officers. Several men stated that there are certain project engineers in their districts who chronically turn in the Construction Record either wrong, late, or incomplete. They can tell by the project engineer's name on the Construction Record whether they are going to have trouble checking it or not. Also, there are several project engineers in each district who turn

the Construction Records in early and correct almost every time. It

seems as though all project engineers should attend periodic workshops

on the preparation of Construction Records taught by District Review

Officers. This would clarify the mistakes that are made, along with

having the project engineers hear suggestions or "tricks of the trade"

from their peers.

The late issuance of the Division of Materials and Tests certifica-

tion also upsets most of the District Review Officers. Few know why

this was happening. However, recent changes in the procedure of the

Division of Materials and Tests as will be discussed in Chapter 5 of this

paper should greatly alleviate this reason for interest penalties.

A few other reasons for interest penalties were stated by the

District Review Officers. These included late District Office

Materials' Laboratory certifications, variations in the types of

project engineers (city, county, or state), the Failure Committee

at the Central Office meets only once a month, and that the Central

Office requires too many reports (daily, weekly, and monthly). The

only one of these of major consequence is the variation of project

engineer type. It and another reason will be discussed in the next

two sub-sections.

3.2.1 Construction Record Versus Type of Project Engineer

The District Review Officers stated that they noticed

a great difference between the quality of Construction Records pre-

pared by the state project engineers and those put together by the

city or county project engineers. They said that the city and county

project engineers make many more mistakes in completing the Construction

Record than do the State of Indiana project engineers. This is probably due to the more experience the state project engineers have in completing a Construction Record. A few of the District Review Officers stated that they find it easier to personally correct many of the mistakes of the city or county project engineers rather than having them come in to correct the Construction Record. It seems to the researchers that the city and county project engineers should also attend the proposed Construction Record workshops taught by the District Review Officers. Experience will not help them if they keep completing the Construction Record incorrectly.

3.2.2 District Office Material Certifications

Only one District Review Officer expressed that he sometimes has problems getting District Office Materials' Laboratory certifications. The other five men seemed to have very good rapport with the district testing men and it only takes one to three days to get a certification in these districts. One District Review Officer even expressed the fact the the material's laboratory in his district has agreed to work on those contracts which are late in the 180 day payment period first. This type of cooperation saves the State of Indiana money in interest penalties.

3.3 Review Personnel

It was quickly discovered by the researchers that the majority of the districts vary with respect to the personnel completing the final construction contract payment procedure review process. All of the districts obtain extra personnel during the winter months

due to inclement weather making field personnel available for office
work. However, during the remainder of the year, two District Review
Officers work by themselves in completing the reviewing and checking
of the Construction Records. The number of review personnel in the
other four districts including the District Review Officer varies
from three to six. In the districts which have review personnel
besides the District Review Officer, each Construction Record is
usually broken down so that the same person checks the same work item
categories for each contract. This helps to reduce the number of
review errors. However, a few of these districts allow one person
to review the entire Construction Record if it is for a small contract.
Not one of the District Review Officers stated that he needed more
review personnel-- including the two men who work alone. However,
the researchers feel that a recommendation is in order here. It
seems that something is wrong with the personnel utilization system
of the Indiana State Highway Commission when it assigns six review
men to one district and only one to another. The amazing fact is that
the two districts operating with only a District Review Officer
had two of the lowest interest penalty percentages and totals for the
1972 through 1976 contractual data. Therefore, the researchers pro-
pose that each District Review Officer should be assigned a field-
experienced assistant, and that these two persons should carry out
the entire review procedure. This would eliminate **unneeded** personnel,
along with allowing those two District Review Officers without as-
sistants some relief. In view of the fact that fewer highway related
contracts are being let due to the near completion of the interstate

system, two review officers should suffice for each district.

3.4 District Review Officer Interaction

All of the District Review Officers expressed the fact that there has been no interaction between them for five to six years. Only two of the six know one another. All said that they would like to have an annual meeting where they could discuss construction contract procedures. It seems as though this would be a very good idea. The six District Review Officers could get together with personnel from the Central Office and discuss general procedures, possible improvements, and problems encountered at the present. Each District Review Officer could state a few of his problems and others of the group who might have already solved the same problems could present their solutions. Another reason for the annual meeting is to prevent gross divergence from contract procedures. At the present, the six District Review Officers are all following their own pathways. These are not too different from the stipulated procedure; however, there is the possibility of ending up with six different payment procedures in the future. The researchers feel that the District Review Officers would be more than willing to participate in such joint meetings.

3.5 Recommendations for Improving the Final Construction Contract
Payment Procedure

Most of the District Review Officers discussed the fact of late initiation of needed change orders by the project engineers. A change order is required any time there is a change from the original

plans or estimate which makes the total contract amount increase. The project engineer then documents this change with its anticipated cost on an IC 626 form which is entitled a Recommended Change in Plans, Materials, or Quantities. Two problems have arisen out of the use of this form. First, many project engineers wait until the end of the job to initiate this form, even though the change took place much earlier in the project. This holds up the payment procedure process and the District Review Officers feel that this is mainly due to inexperienced project engineers. Again, an annual workshop for project engineers would help to alleviate this problem. Secondly, some of the District Review Officers say that the project engineers do not complete an IC 626 until they have exact quantities. It is felt that if a change can be foreseen but exact quantities are not known, such as with cut and fill, it would be better to begin the process by turning in an estimated IC 626 so the Indiana State Highway Commission will know it needs extra money for this contract.

Only one District Review Officer did not agree with the policy of working on Construction Records that are late in the 180 day payment period first. Five of them stated that if they are working on other Construction Records and one comes in which is late and which will have a substantial interest penalty if not processed promptly, they will switch their efforts over to this new one. This shows the desire of the District Review Officers of having the lowest penalty amount possible. The sixth District Review Officer brought up the point that looks at things from the contractor's point of view. By working on the late contract first, you save money for the State

of Indiana. However, why should the contractors whose contracts were turned in earlier have to wait for their final payment just so the State of Indiana saves money? The researchers can see this District Review Officer's point, but it should be remembered that he is working for the State of Indiana, not the contractors. Therefore, he is obligated to save as much money for the State of Indiana as he can.

A third recommended improvement deals with retainage reductions. Several of the District Review Officers feel that retainages could be dropped much sooner than they actually are. A dropped retainage saves many dollars in interest penalties. Because of this, when some of the District Review Officers see that the final construction contract payment procedure is running late, they mention to the Construction Engineer of the district that it might be a good idea to lower the percentage retained. Since the contractor has to make the formal request, he is informed that the State of Indiana is willing to make the reduction. No contractor with any common sense will reject this offer; however, the State of Indiana must protect itself before dropping the retainage. If the contract is running late and liquidated damages are due to the State of Indiana, the chances of dropping the retainage are much slimmer. Therefore, the State of Indiana must weigh two evils here-- leave the retainage as it is and pay a higher penalty or drop it and take the chance of not recovering the liquidated damages. Only a value engineering judgement for each individual case will give the correct answer. The point of this improvement idea is to reduce the retainage as much and as soon as possible.

Another recommendation deals with job personnel. One of the District Review Officers mentioned that every project engineer should be assigned an assistant. Some have them now and some do not. This assistant could work in the field office trailer and be completing a lot of the Construction Record paperwork throughout the job, such as making the necessary sketches and adding up all of the weigh tickets. This would give the project engineer more time on the job and make it an easier task to complete the Construction Record at the end of the project.

Another improvement suggestion deals with checking the Construction Record in sections throughout the job. All jobs are divided into components and a lot of the time a part is completed early in the job and no work is added to it later. In cases like this, a District Review Officer mentioned that he tells his project engineers to complete the paperwork for this part of the job and send it to the District Office whenever it is completed. This way, the whole Construction Record does not have to be checked at the end of the job. It seems as though this is a very good idea which could induce the project engineers to do a little of their work at a time instead of waiting until the end of the job to do it. Also, dealing with this is what one of the District Review Officers does in his district. If there is not much to check in the office, he will periodically go to the jobs and pick up from the project engineers items such as weigh tickets so he can get them all tabulated prior to when the Construction Record arrives. This saves him a lot of time in the long run.

A few of the District Review Officers seem to have a good idea with respect to organization throughout the checking process. They have a board in front of their desk showing the status of each contract being checked. Using this system, they can tell which contracts are running late in the 180 day payment period. This type of organization should be used throughout all six highway districts.

Added documentation is another recommendation of one of the District Review Officers. He stated that the project engineers are accustomed to calling contractors when supplemental material records are needed or when the M-39 is late being turned back signed. Because of this verbal system, some contractors claim they were never called and try to pin the time delay on the State of Indiana. Dated written letters of which copies are kept by the project engineer would help to alleviate such claims.

Finally, a few of the District Review Officers stated that their work might improve if they knew what their exact job description is. For example, they sometimes find numerical errors made by the project engineer during his calculations. The District Review Officer can either make the needed change himself or call the project engineer in to do this. In most cases, they make the change themselves. However, they are afraid of the possible consequences. One is so bold that he will fill in a supplemental material record and forge the project engineer's signature to it because this document is all that is holding up material certifications. As can be seen, some guidelines need to be set up so these men know what they can and cannot do legally.

3.6 Recommendations for Improving the Indiana State Highway Commission

1970 Construction Record Guide for Road, Bridge, Maintenance, and

Traffic Contracts

None of the District Review Officers voiced any major complaints about the Construction Record Guide. All felt that it served its purpose on the whole, but they did each give the researchers a few of their suggestions on how it could be improved. Most of these deal with certain forms placed in the Construction Record. However, a few deal with needed sections. Each will be discussed separately below.

a) Repetition of sketches- Several District Review Officers said that many of the project engineers recopy their field book sketches onto IC 614 forms. This type of repetition is unnecessary. If they would take their time when drawing their original field sketches, the field book containing them could be referenced for a needed sketch. The field books become a part of the Construction Record anyway. This would cut down on the amount of paperwork in the Construction Record along with making it easier for both the project engineer and the District Review Officer.

b) Bridge deck repair items- Two of the District Review Officers mentioned that the Construction Record Guide contains no section showing samples of how to check bridge deck repair and overlay items. These items include hand chipping and scarifying. The District Review Officers are not sure of the proper quantities for these items and feel a section is needed to cover this topic.

c) <u>Accuracy of calculations</u>- It was mentioned that several of the project engineers are not following the calculation accuracies shown for the work items in the front of the <u>Construction Record Guide</u>. They are not following the rounding rules for the quantities. Again, an annual work-shop for the project engineers should help clear up this problem.

d) <u>Federal funding section</u>- One of the District Review Officers said that he would like to see a new section in the <u>Construction Record Guide</u> on how to handle federally funded contracts. In these contracts, there are often work items, signified as Z items, which are not federally funded while the rest of the contract is. As a note to the District Review Officers, this problem is adequately discussed in the Supplemental Instructions to Field Employees--No. 18 which was issued September 7, 1973 by W. J. Ritman, Chief of the Division of Construction of the Indiana State Highway Commission. A copy of this directive could easily be included in the <u>Construction Record Guide</u>.

e) <u>IC 612B form- Pipe and Concrete Structures</u>- The majority of the District Review Officers feel that this form is use-less. It is used to show how much of each type of pipe is laid and where. It is felt that this form repeats information shown in the project engineer's field book and is unnecessary. Therefore, the pipe information could be referenced on an IC 627 to the field book and this IC 612B form could be eliminated.

f) <u>Computerized dirt quantities</u>- At present, the computer does
a lot of the project engineer's dirt calculations for him.
He fills out a data input sheet using numbers from his field
book and the computer prints out quantities and cross
sections. This printout is then included in the Construction
Record. However, a District Review Officer expressed concern
as to how to check these computer printouts. The only
thing he can check at the present is whether the project
engineer made the proper transposition of field book numbers
to the computer data input sheets. There is no way of his
knowing if the project engineer made an error in his field-
book. Therefore, the District Review Officers need actual
as-built cross sections to compare with the computer's printout.

g) <u>IC 611A form- Pavement</u>- This form for pavement quantities
is also felt to be unnecessary by some of the District
Review Officers. This same information should be in the
project engineer's field book.

h) <u>IC 654 form- Record of Construction (Concrete)</u>- This form
was revised in May 1972 so the old form is still in the
<u>Construction Record Guide.</u> A few of the District Review
Officers mentioned that they are not sure what goes in all
of the blocks on this form. A new sample form which is
explained should be placed in the <u>Construction Record Guide</u>.
A meeting between the District Review Officers would help
clear up this problem also.

i) <u>Date repetition</u>- A few of the District Review Officers felt

that there was unneeded repetition of dates on forms such as
the IC 608 (Title Sheet), the IC 654 (Record of Construction-
Concrete), the IC 635 (Record of Completion and Acceptance),
and the IC 632 (Completion Date and Liquidated Damage Data).
However, these forms are all required to be in the Construction
Record and some of the repeated dates are pertinent to the
form. Therefore, the researchers feel that this repetition
of dates is all right as long as care is taken so that the
dates do not vary from form to form.

3.7 Summary

As can be seen, the District Review Officers provided a lot of
valuable information that the researchers used in preparing this
chapter. The places of disagreement between those men and the
researchers were noted. It is felt that a lot of the suggestions
offered by the District Review Officers would greatly increase the
efficiency of the final construction contract payment procedure.

CHAPTER 4

RESULTS OF INTERVIEWS WITH ISHC PROJECT ENGINEERS

As was stated in Section 1.3 of this paper, interviews with several project engineers were carried out in the Crawfordsville district. The main reason for this was because of this district's proximity to Purdue University. The project engineers responded to a set of questions similar to those asked the District Review Officers. However, the primary emphasis of the questioning was placed upon the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts. The project engineers use this manual the most of all of the Indiana State Highway Commission personnel. Therefore, their familiarity with the book made it easy for them to state their likes and dislikes about it.

The primary point that each of the interviewed project engineers made about the Construction Record Guide is that it is not too bad. It is not hard to follow and it contains the answers to most of the questions that arise during the preparation of the Construction Record. However, each did present a few suggestions on how the book could be improved. It should be noted here that a lot of their suggestions about the Construction Record Guide are the same as were given by the District Review Officers. Since these identical suggestions are explained in Chapter 3 of this paper, they will only

be listed here. However, previously unexplained suggestions will
be presented in detail. Also, general suggestions about the final
construction contract payment procedure as were put forth by the
project engineers will be listed. The following three sections
present the results of the interviews with the project engineers.

4.1 Suggestions about the Construction Record Guide Which Were Made by Both the Project Engineers and the District Review Officers

a) Repetition of sketches is unnecessary.

b) Bridge deck repair item needed in the the Construction
Record Guide.

c) Difficulty of filling out the IC 612B form pertaining to
pipe and concrete structures.

4.2 Other Project Engineer Suggestions on Improving the Construction Record Guide

a) Make more references to the project engineer's field book.
Many of the project engineers feel that there is a lot of
recopying of field book information onto IC 615 forms which
are placed in the Construction Record. These IC 615 forms
are used mainly for drawings. It is felt that it would
involve much less paperwork if the pertinent page in the
field book was referenced instead of writing up a new form.
The researchers concur in this belief.

b) Provide all project engineers with a sheet showing the
Central Office's recommendation for the order of pages in the Con-
struction Record. This sheet should be used by all six

State of Indiana districts. The project engineers complained
that the page order of the required forms changes from time
to time and a general instruction sheet from the Central
Office would be very helpful.

c) Provide an example of Unclassified Excavation.

4.3 Project Engineer Suggestions on the Payment Procedure Process

a) In order to speed up the process, the project engineer
could begin filling out the IC 627 forms for each work item
before the actual project even begins. IC 627 forms are
used for work item quantity summaries and comparisons.
He could fill in the heading and the plan quantities.
Then as each item is finished, he could complete the IC 627.

b) In order to check the contractor's IT 611 form (the Material
Record form), the project engineer could make up his own
each month from his observations and then at the end of the
month, check the form turned in by the contractor with his
own. His form would give him a record of what material he
knows is on the job and it would reduce the amount of
checking required to determine if the contractor left some-
thing off or had an improper quantity.

c) It would be better to be conservative and overestimate
on the IC 626 forms. An IC 626 is a form entitled Change
in Plans, Materials, or Quantities. The project engineer
fills out this recommendation form if he encounters any
work item quantity changes during the project. Being

conservative on this form would assure that if approved,

the money would be available and hopefully some of it would

not be used.

d) Require all District Review Officers to be field experienced

and graduate civil engineers. The reason for this deals with

their checking responsibility. Right now, their main job

is to sum quantities and to make sure all of the required

forms have been submitted by the project engineer. They

do not check the thought behind how these quantities were

arrived at. If they do have a quantity question, the proj-

ect engineer is able to give an explanation that the District

Review Officer does not sometimes understand but assumes

is feasible. Therefore, it would be better to have a per-

son checking the Construction Record who is also capable

of checking the project engineer's method of calculating

quantities.

4.4 Summary

As can be seen from the number of suggestions provided by the

project engineers, they do not have too many complaints about the

payment procedure or the Construction Record Guide. However, through

interviewing the project engineers, the researchers discovered that

both the Indiana State Highway Commission officials (including the

District Review Officers) and the contractual data are correct about

the project engineers. Most do not finish their paperwork as soon

as they could. Only a few out of the several project engineers

who were talked to stated that when a work item is completed, they
immediately complete the required paperwork that goes along with it.
This one step would reduce the amount of paperwork time being spent
at the end of the job and this would reduce interest penalties.
The researchers realize that no one likes to do the paperwork but it
is a necessary evil. To put it off because you could be doing some-
thing else only makes you resent it more when you have to do it
later. Therefore, it is recommended that the Indiana State Highway
Commission strongly emphasize to its project engineers the expediency
of completing construction reports as segments of the work already
completed. District Review Officers and the District Construction
Engineers could also implement this philosophy into practice. Project
engineers who continue to perform poorly on project reports should
be relieved of their positions.

CHAPTER 5

RESULTS OF INTERVIEWS AT THE DIVISION OF MATERIALS AND TESTS

As was seen on the final construction contract payment procedure
flowchart in Figure 1, the issuance of a Division of Materials and
Tests certification is one of the primary components of the process.
This division of the Indiana State Highway Commission is located in
Indianapolis. In the researchers' interviews with Indiana State
Highway Commission officers in the Indianapolis Central Office, with the
District Review Officers, and with the project engineers, this division
was constantly mentioned as one of the main reasons that interest
penalties were occurring. The Penalty History Analysis section (7.7)
of the Data Analysis chapter presents data that substantiates this
opinion. Therefore, the reasearchers traveled to the Division of
Materials and Tests assuming it contributed to one of the final
construction contract payment procedure's main problems and hoped
that by talking to the personnel there that they could discover
the basis for the problems. They also hoped to come up with recom-
mendations that might improve this division. The researchers found
something quite the contrary when they interviewed three of the men
there. There has been a change in procedure at the Division of
Materials and Tests which began approximately in March of 1977.
It looks as though the efficiency of the division will be greatly
increased by this new procedure and, hopefully, reductions in

future contract penalty data will bear this out. Some of their
old policies did contribute to their division being a major cause of
interest penalties, but most of those policies have been changed.
Therefore, this chapter will present information in the following
sections:

   5.1 The Functions of the Division of Materials and Tests

   5.2 The Organizational Structure of the Division of Materials
       and Tests

   5.3 The Flow of Paperwork Through the Division of Materials
       and Tests

   5.4 Management Checks to Increase the Division's Efficiency

   5.5 Possible Reasons for Late Issuance of a Division of Materials
       and Tests Certification That Are Not the Fault of the
       Division

   5.6 Recommendations

   5.7 Summary

5.1 The Functions of the Division of Materials and Tests

     The primary objective of the Division of Materials and Tests
is to certify that all materials used on a construction project meet
State of Indiana specifications. It accomplishes this either by
testing a sample of each material in its laboratories or by checking
a manufacturer's certification test. The Division of Materials and
Tests also checks to make sure that for each quantity of material
used on a project, the right frequency of sample spot checks have
been made. For example, a slump test is required for all concrete

paving operations. The <u>Manual for Frequency of Sampling and Testing</u> <u>and Basis for Use of Materials</u> states that one slump test is required for every 2000 linear feet of pavement but no fewer than one slump test should be taken each day. Therefore, if 4000 linear feet of concrete pavement are laid in one day, the Division of Materials and Tests makes sure two slump test reports are sent to them for checking. The third category the Division of Materials and Tests checks is the basis for use of materials used on a contract. When a project engineer fills in the Basis for Use column on the Material Record form (IT 611), he is showing his criteria for accepting the material for his construction project. He can justify material acceptance either by a Division of Materials and Tests sample test, a manufacturer's certification, or by visual approval. However, certain materials require a certain test to show up on the Basis for Use column to assure the material is all right to use on the job. For example, there are three types of material certifications that can be received from a manufacturer-- namely A, B, and C. Type A is the highest level of certification in that it contains with it a certified copy of a laboratory report showing actual test results which meet State of Indiana specifications on the material tested. The type C certification is the lowest level since it certifies only that the material supplied by the manufacturer complies with the State of Indiana specifications. Therefore, if a material calls for a type C certification in the Basis for Use column, a type A, type B, or type C certification will suffice. However, if a type A certification is called for and a type C is received from the manufacturer, the project

engineer cannot accept the material. Using the Manual for Frequency of Sampling and Testing and Basis for Use of Materials, the Division of Materials and Tests makes sure that the project engineer has made no mistakes in approving materials without the proper testing certification. The fourth and final set of information that the Division of Materials and Tests checks for on each contract is final payment quantities. Every month, it receives Material Record forms (IT 611) that show the quantity of each material used by the contractor during the month. At the end of the project, these monthly totals for each work item are summed to arrive at job quantities. The Division of Materials and Tests also receives at the end of the job IC 642 forms. These forms, entitled Comparison of Estimates--Original and Final, show the final quantity of each work item for which the State of Indiana expects to pay the contractor. The Division of Materials and Tests makes sure that its quantity totals derived from the IT 611's are equal to or greater than the payment quantities shown on the IC 642. If the totals on the IT 611's are smaller, this could mean that without this checking procedure, the State of Indiana could end up paying for more material than was used on a job. If the totals are larger, the State is getting more material than it is paying for.

5.2 The Organizational Structure of the Division of Materials and Tests

The Division of Materials and Tests is composed of four divisions. Each is responsible for checking different work item quantities on both the IT 611's and the IC 642's. The first division is called Field Control. It is responsible for checking quantities on work items such as pipe and its accessories, aggregates, and bituminous

materials. The second division is the Soil Department. It checks
soil quantities such as those for B-Borrow, compacted base material,
and common excavation. The third section is entitled Research and
Development and the primary category of work items that it checks is
concrete. The fourth division is called the General Office. It
checks items such as dry cement, asphalt, reinforcing steel, and
metal products such as signs or guardrails. Due to the fact that
each division checks different work item quantities, all of the
paperwork has to flow through all four divisions; how this is ac-
complished is explained in the next section.

5.3 The Flow of Paperwork Through the Division of Materials and Tests

How the paperwork flows through the Division of Materials and
Tests is very important to its efficiency. Each step in the process
will be discussed in detail and improvements to the procedure which
were made in March 1977 will be pointed out. The steps are as follows:

a) RECEIPT AND CHECKING OF THE MATERIAL RECORD FORMS (IT 611)-
   Each month in which a project is in progress, the Division
   of Materials and Tests receives an IT 611 for every project
   that is in progress in each district. This form is sent from
   the District Office. It is logged in on a sheet showing the
   date it was received. The IT 611 then has a distribution
   stamp place on it by the Assistant to the Office Engineer
   for routing through all four sections of the Division of
   Materials and Tests. He then starts the form's distribution
   to a division such as Field Control. The IT 611 is hand
   carried to Field Control which checks to make sure the

correct number of sample tests have been completed for each
work item shown on the IT 611 along with checking that the
Basis for Use column and the Source of Supply column for
each work item are correct. After sending the IT 611 to one
of the four divisions, the Assistant to the Office Engineer
expects the checked IT 611 to be back on his desk within a
week in order to distribute it to the next division. If it
is not, he goes to that division and picks it up himself
after making sure it was checked. Prior to March 1977,
after sending the IT 611 to a division, there was no re-
quirement that it be back to the central distribution point
within a week. It would sometimes sit on a man's desk for
weeks or even months if the man happened to be sick, on
vacation, or just busy. This change in procedure alone
should greatly increase the efficiency of the Division of
Materials and Tests and decrease the number of times it is
a cause for an interest penalty. As was stated previously,
this checking process is repeated monthly for each new set
of IT 611's that arrives at the Division of Materials and
Tests from the districts. The division strives to complete this
checking process prior to the arrival of the new crop of
IT 611's. This prevents a backlog of work along with
utilizing the common sense policy of doing your work a little
at a time instead of waiting until the end of the job to
begin it.

b) RECEIPT AND CHECKING OF THE PRELIMINARY COMPARISON OF ESTIMATES-
ORIGINAL AND FINAL FORM (IC 642)- After the project has been
completed and the project engineer has turned in the Construc-
tion Record to the District Office, they transfer his work
item total quantities onto an IC 642 which is sent to the
Division of Materials and Tests. This form is then logged
in by the Assistant to the Office Engineer who also places
the distribution stamp on it. It is then sent to each
division in the same manner as the IT 611's were. If the
IC 642 is not back within a week, he goes looking for it and
finds out why there is a hold-up in the process. Each
division totals up the IT 611 quantities it has checked for
the project and makes sure this sum is equal to or greater
than the sum shown on the IC 642. If the sum of a work
item is smaller, a discrepancy letter is issued to the
district explaining the problem and asking for its assistance
in solving it. Many times, an IT 611 is not sent to the
Division of Materials and Tests and this makes the IT 611
total quantity less than the IC 642 quantity. Also, a con-
tractor frequently leaves off an item on the IT 611 which is
missed by the project engineer who checks this form. This
makes the IT 611 total work item quantity too low. A sup-
plemental IT 611 is needed in this case to make sure the IT 611
total quantity is equal to or greater than the IC 642 quantity.
When answers are received to the discrepancy letter, the
quantities can then be okayed. If an answer is not received

within two weeks, a call is made to find out why.

c) RECEIPT AND CHECKING OF THE FINAL COMPARISON OF ESTIMATES-
ORIGINAL AND FINAL FORM (IC 642)- After the District Office
has checked the Construction Record for final work item
quantities, it issues a final IC 642 to the Division of
Materials and Tests. This form usually shows the same
work item quantities that were seen on the preliminary
IC 642. Because of this, the Assistant to the Office
Engineer checks this form against the IT 611 total quantities.
However, if a work item on the final IC 642 shows a big
change in quantity from the preliminary IC 642, he sends
the final IC 642 to the appropriate division in the Divi-
sion of Materials and Tests for checking.

d) RECEIPT OF THE DISTRICT OFFICE MATERIALS' LABORATORY
CERTIFICATION- The District Office is also required to
submit a material certification on items that it tests.
The District Office Materials' Laboratory checks items such
as aggregate gradation and air content of concrete but it
does not have the capability of checking things such as the
tensile strength of reinforcing steel, paint mixtures,
epoxy characteristics, or the compressive strength of
concrete. Therefore, the Division of Materials and Tests
must wait and make sure the District Office Materials'
Laboratory issues its certification. After this has been
done and a copy has been sent to the Division of Materials
and Tests, it can then issue the Division of Materials and
Tests certification.

e) ISSUANCE OF THE DIVISION OF MATERIALS AND TESTS CERTIFICATION-

Many facts have to be assured before the issuance of the

certification. They are as follows:

1) All of the discrepancy letters to the districts have

had to have been answered satisfactorily. The needed

IT 611's or supplementary IT 611's must have been

received and checked in the Division of Materials and

Tests.

2) A copy of the District Office Materials' Laboratory

certification must be on file in the Division of

Materials and Tests.

3) Throughout the project, the Division of Materials

and Tests is testing samples of materials used on the

job. If any of the samples fail to meet the spec-

ifications, a pink sheet is issued to the project

engineer notifying him of this fact. The failures

are also discussed once a month by the Failure Com-

mittee in the Central Office in Indianapolis. They

determine if the material can be used or if new

material is required. If the failed material is

approved by the Failure Committee, the Division

of Materials and Tests then writes exception letters

to the districts and project engineers about these

failures. All of the failed material pink sheets

have to be cleared up prior to the issuance of the

Division of Materials and Tests certification.

4) If a project engineer has put down the wrong basis for use for a work item on the IT 611, a blue letter is issued notifying him of this fact. All correct basis for use certifications are required prior to certification issuance.

After all of the four facts as discussed above have been assured along with those pertaining to the IT 611's and the IC 642's, the Division of Materials and Tests issues its certification.

5.4 Management Checks to Increase the Division's Efficiency

In order to increase its efficiency and to assure that it causes a low percentage of the interest penalties, the Division of Materials and Tests utilizes a few checking systems which are the responsibility of the Assistant to the Office Engineer. The first of these is the IT 611 summary sheet. The Division of Materials and Tests knows all of the contracts that are in progress by its receipt of an IT 611 each month from all contracts. It keeps track of all IT 611's that are received and it compiles a list of all IT 611's that were not received during the month for contracts still in progress. The Division of Materials and Tests knows a contract is still in progress if it has not yet received an IC 642 from the District Office. This list is then sent to each district every month. The district is required to respond about all IT 611's pertaining to it that have not been received by the Division of Materials and Tests. This checking system finds mistakes sooner and should decrease interest penalties. The second checking system pertains to the IC 727 form

issued by the Indiana State Highway Commission each month. This

form, entitled the Road and Bridge Construction Record Status Report,

lists all contracts which have been completed but for which final

payments have not been made. It lists reasons why the final construc-

tion contract payment procedure is still in progress. Many of the

reason entries state that the contract is awaiting Division of

Materials and Tests certification. The Assistant to the Office

Engineer goes over every contract on this form each month and checks to

see what his division's status is in the flow of its checking pro-

cedure. He makes sure all of his contract IT 611 and IC 642 checking

is up to date along with determining if the hold-up is due not to

his office but to the District Office or the project engineer. This

checking system makes the Division of Materials and Tests aware of the

status of all contracts and should lead to fewer interest penalty

causing errors. The third and final checking system deals with the

distribution stamp already mentioned. For every contract that the

Division of Materials and Tests is working on, a form is stamped

showing the four different divisions and the dates the IT 611's and

the IC 642's were sent to and received from the divisions. If

blanks show up on the date blocks, it means that the forms are still

in a certain division or haven't been sent there yet. This checking

procedure assures complete distribution along with making the Assistant

to the Office Engineer aware of any long delays in a certain section.

All three of the mentioned checking systems appear very adequate

and can do nothing but to improve the final construction contract

payment procedure.

5.5 Possible Reasons for Late Issuance of a Division of Materials and Tests Certification That Are Not the Fault of the Division

In defense of the Division of Materials and Tests, it appears that this group is blamed for a lot of delays in the final construction contract payment procedure which are the fault of other groups of people. When the IC 727 states that the contract is awaiting the Division of Materials and Tests certification, several factors could be the cause of this but which are not the fault of this division. Each factor to be mentioned has been discussed in this chapter but not in this context. They are as follows:

a) <u>Discrepancy letters</u>- If a work item quantity is found to be incorrect, it is the fault of the contractor or project engineer, not the Division of Materials and Tests unless this division lost a form. All of these discrepancy letters have to be cleared up prior to certification issuance.

b) <u>Failed tests</u>- If a material sample fails a test and the Failure Committee has not yet discussed the matter, the delay is not the fault of the Division of Materials and Tests.

c) <u>Basis for Use Certifications</u>- If the project engineer puts down an incorrect basis for use and a delay results, it is his fault, not the Division of Materials and Tests.

d) <u>District Office Materials' Laboratory certification</u>- Even if the Division of Materials and Tests has all of its work done, it can not issue a certification until it receives the same from the District Office Materials' Laboratory. This again is not the fault of the Division of Materials and Tests.

All four of the factors discussed above help to decrease the percentage
of contracts in which interest penalties were caused by the Division
of Materials and Tests. This fact is reiterated in the Penalty
History Analysis section (7.7) of the Data Analysis chapter. However,
it should be remembered that prior to March 1977, the division's
operations were much more inefficient than they are now. The division
did cause a large share of the interest penalties but its improvements
should decrease this percentage. Recommendations on how the Divison
of Materials and Tests could be further improved will be discussed
in the next section.

5.6 Recommendations

Even though the efficiency of the Division of Materials and Tests
was increased with the changes made in March 1977, there is still
room for improvement. The following recommendations are offered for
future consideration and possible implementation:

a) Stop both distribution cycles- At present, the IT 611's are
    sent through the four stop cycle each month along with the
    preliminary IC 642 at the end of the job. The thousands of
    forms that travel through these cycles each year present many
    chances for lost or misplaced forms. Also, the work required
    to keep track of where the forms are and should be in the
    cycle is immeasurable. Therefore, it is recommended to keep
    all of the forms at one desk, namely that of the Assistant
    to the Office Engineer. He then would not have to keep
    track of where all the forms are since he would have them.

If he was given an assistant to help him, he could perform all of the work the four sections do now. This could save the State of Indiana money in salaries since it would be deleting unnecessary personnel.

b) Issue the Division of Materials and Tests certification without having the District Office Materials' Laboratory certification- The researchers feel that the hold-up that occurs when there is a wait on this District Office certification is unnecessary. Even more unnecessary is the need for two separate material certifications. It seems as though every sample of every work item could be checked in the Division of Materials and Tests. Even if this drastic step is not taken, the need to wait on the District Office Materials' Laboratory certification is unjustified since when the Division of Materials and Tests issues its certification, it is certifying every piece of material on the job.

c) Check all Manufacturer's certifications- At present, the number of manufacturing firms' certifications which are checked for accuracy is very low due to not having enough personnel. The State of Indiana is assuming that the test results from the manufacturers are valid in almost all cases. Tests by the Division of Materials and Tests have shown that mistakes are made by the manufacturers and results which they say meet the specifications really do not. Therefore, all manufacturer certifications should be checked by the Division of Materials and Tests' personnel, even if

more personnel are needed by this division.

d) Computerize the paperwork procedure through the Division
    of Materials and Tests- Almost the entire checking procedure
    could be easily computerized. The computer could total up
    IT 611 work item quantities and make sure the quantities
    are equal to or greater than the IC 642 quantities. The
    computer could determine if the required number of sample
    tests were taken according to the work item quantities.
    Finally, the computer could check to see if the Basis for
    Use certifications are as required. For each of these
    three computerized activities, the computer would print
    out an error message when there is noncompliance to Indiana
    State Highway Commission specifications. At present, the
    computer prints out for project engineers test results of
    samples that have been sent in to the Division of Materials
    and Tests. The researchers feel the added computerization
    could greatly aid the paperwork aspect of this division.
Each of the above suggestions should help the final construction
contract payment procedure in that each will increase its efficiency.

5.7 Summary

This chapter has shown the results of the researchers' discussions
with Division of Materials and Tests personnel along with stating a
few of their own opinions. The present procedure, greatly improved
over the past, was laid out. Finally, it is felt that implementation
of one or all of the recommendations could greatly expedite the pay-
ment process.

CHAPTER 6

RESULTS OF THE REVIEW OF THE <u>INDIANA STATE HIGHWAY COMMISSION 1970</u>
<u>CONSTRUCTION RECORD GUIDE FOR ROAD, BRIDGE, MAINTENANCE, AND TRAFFIC</u>
<u>CONTRACTS</u>

One of the primary objectives of this research study was to
thoroughly review the <u>Indiana State Highway Commission 1970 Con-</u>
<u>struction Record Guide for Road, Bridge, Maintenance, and Traffic</u>
<u>Contracts</u>. It was prepared in 1970 and has not been updated since
that time. The guide is used by the project engineer as a reference
of how to complete the work item quantities for the contract he is
supervising. During the Joint Highway Research Advisory Board meeting
on December 1, 1976 in which the proposal for this research study
was approved, it was stated by one of the Indiana State Highway
Commission officials that it might be good for a layman like the
researcher to study this book and propose improvements. Since the
researcher has never been a project engineer for the State of Indiana
and therefore has never prepared a final Construction Record utilizing
this book, he felt that the best way for him to review it was to go
through the guide page by page and see if he could follow the work
item examples. The results of this review are interesting and appear
in the following few paragraphs.

The first thing noticed by the researcher about the guide during
its review was the number of mistakes it contains. These errors
include numerical calculation errors, misspellings, and incorrect

transpositions of data from page to page. A listing of all of these mistakes can be found in Appendix C. These errata sheets should be issued to all project engineers so they can correct their Construction Record Guides. The project engineer completing the final construction contract payment procedure for the first time relies heavily upon this book. In order to compute some of his work item quantities, he has to follow the examples in the guide step by step. Examples with mathematical mistakes in them make it harder on the neophyte. He gets confused when his calculations which are correct give him one answer while the guide's calculations, which he assumes to be correct but are not, give him another. Therefore, a careful check of the next edition of the guide could prevent a lot of headaches.

The layout of the Construction Record Guide seems adequate. It is divided into several major topics such as Grading Items, Bridge Items, and Traffic Items. This type of organization provides for easy referencing by the project engineer.

The researcher's review of the guide resulted in no new recommendations for its improvement beyond those found in the interview chapters of this paper with both the project engineers and the District Review Officers (chapters 3 and 4). Each of those two chapters listed several improvements to the guide which will not be repeated here. However, it should be stated that the researchers feel that the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts is on the whole adequate and provides a good reference for both new and experienced project engineers. The guide does not inhibit the efficiency of

the final construction contract payment procedure process. As the
Data Analysis chapter will show, the person using the Construction
Record Guide is the primary reason for the problems with the payment
process. The guide lays down the proper ways of computing the work
item quantities, but getting the project engineers to compute them
on time and correctly is another matter.

CHAPTER 7

DATA ANALYSIS

As was mentioned in the Objectives of the Study section (1.2),
the data analysis of the final construction contract payment procedure
encompasses all highway related construction contract data for
Indiana since 1972. The reason for this is twofold. First, the
180 day payment statute was passed in 1972, so there would not be
any contract penalties prior to that year. Secondly, the State of
Indiana began compiling contract data using a computer in 1972.
Therefore, it was much easier for the researchers to scan the computer
printouts for data rather than to dig through the Indiana State
Highway Commission's archives to find pertinent highway related
construction contract data. A sample of the contract data issued
by the State of Indiana is shown in the Computer Program Development
section (7.1).

The data analysis covers a wide range of topics. All pertain
to contract penalties but some look at the interest penalties from
different viewpoints. The following are the sections of this
Data Analysis chapter:

7.1 Computer Program Development

7.2 Penalty Breakdown by Year

7.3 Penalty Breakdown by Contract Type

7.4 Penalty Breakdown by Contract Duration

7.5   Penalty Breakdown by Geographic District

7.6   Penalty Breakdown by Project Engineer Type

7.7   Penalty History Analysis

7.8   Liquidated Damages Analysis

Each section will contain an analysis of the trends shown by the
contract data along with pertinent tables or graphs of data. When-
ever penalty totals in terms of dollars ($) are expressed on the
graphs, these sums will have a number in parentheses above them.
This number signifies the number of contracts in which penalties
were paid which make up that total amount. This allows for the
computation of average penalties if it is so desired.

As will be noticed when the data is presented in tabular or
graphic form, no penalties were paid during 1972 and 1973 and very
few were paid in 1974. The reason for this fact has already been
mentioned in the Justification for the Study section (1.1). When
the Indiana General Assembly changed the contract payment statute
in 1972 pertaining to the State of Indiana having 120 days to pay
the contractor, they also decided that this new law could only be
applied on highway related contracts for which bids on these con-
tracts were received from possible contractors on or after March 1, 1972.
In reviewing the Indiana State Highway Commission's computer print-
outs of contract data, the majority of the contracts in which final
payments were made in 1972, 1973, and 1974 were let prior to this
date. Therefore, it is impossible for these contracts to be assessed
an interest penalty, even if they were paid late by the State of
Indiana. The tables and graphs might be misleading to some people.

However, it should be kept in mind that if the new statute had been made retroactive to for example 1970, the penalty totals for 1972, 1973, and 1974 would have shown a large increase over what they show now.

Finally, it should be remembered that the 1977 data points as expressed on the tables and graphs are projections. The actual data compilation ended with the August 31, 1977 computer printout from the Indiana State Highway Commission. This is because it was anticipated that this investigation would be completed by late November 1977. Since time was needed to analyze the data, it was felt by the researchers that cutting the data off three months prior to completion of the study would be feasible. Therefore, the 1977 projections are based on the trends shown by the data during the first eight months of 1977. The eight month dollar totals were multiplied by 1.5 to get the twelve month projections; percentages were not adjusted.

Following this introduction to the Data Analysis chapter are the eight sections which were listed earlier. The researchers know that the data could have been analyzed in other ways and that other variables could have been included during the data analysis besides contract type, project engineer type, year of payment, and geographical district. However, it was felt by the researchers that these four are representative of all others and that an analysis using them would arrive at similar conclusions in comparison to one in which other variables were considered.

7.1 Computer Program Development

The compilation of past and present highway contract data was made much easier through the usage of a computer program. When it was decided that a data analysis was necessary for the contract payment procedure, the fact that the contracts can be broken down in several ways quickly surfaced. These divisions of each contract are as follows:

a) Penalty- yes or no.

b) Contract type- Road, Bridge, Road-Traffic, Road-Surfacing, or Road-Maintenance.

c) Year the contract payment procedure was completed- 1972, 1973, 1974, 1975, 1976, or 1977.

d) Geographic district- Crawfordsville, Fort Wayne, Greenfield, LaPorte, Seymour, or Vincennes.

e) Project engineer type- city, county, or state.

If one takes the product of the number of subdivisions in each division, it can be seen that there are 1080 possible types of contracts. Therefore, it was quickly decided that the time it would take to write a computer program for this data would be very beneficial to the researchers.

With respect to contract data, the researchers were constrained by the fact that the Indianapolis Central Office has been compiling contract data only since 1972. This office releases a computer printout each month showing both the highway contracts which are in progress and those that have been completed during the year. It is from these printouts that the researcher derived the required

information in order to make a data analysis. A sample of the data received from Indianapolis can be seen on the next page in Figure 2. By referring to the headings at the top of the sample, one can easily ascertain what each section of the contract data sample refers to. From this data, the researchers extracted five contract breakdown divisions that they required for the computer program. This data was then placed on computer cards in the following format:

Columns 1-8:   Contract number

Columns 10-11:   Contract type

Column 13:   Project engineer type

Column 15:   Penalty- yes or no

Columns 17-24:   Penalty amount

Column 26:   Geographic district

Columns 28-29:   Reason for penalty

Column 31:   Year the contract payment procedure was
                    completed

A coding system was devised for several of these data components in order to facilitate both programming and data handling. For the type of contract, the coding is as follows:

Contract Type	Code
Road	1
Bridge	2
Road-Traffic	3
Road— Surfacing	4
Road-Maintenance	5

INDIANA STATE HIGHWAY COMMISSION
CONSTRUCTION REPORT

PAGE NO. 2
CRAWFORDSVILLE DISTRICT

FOR PERIOD ENDING OCT 1, 1977

CONTRACT	MILE CONTRACTOR		CODE	BID PRICE	LETTING	CCMP. DATE	PERCENT COMPLETED	LINE B/C
PROJECT	TYPE				FIRST WORK	LAST WORK	A = PERCENT COMPLETED	NO. PRX
STRUCTURE	LOCATION			FINAL PRICE	SIGNED	ACCEPTED	/	RD.
ROAD	COUNTY			INTEREST	180 DAY	REC'D C.C.	+ = PERCENT AHEAD OR BEHIND	RET
LENGTH				LIQ. DAMAGES	NOTICE	FINAL EST.	* MAY JUN JUL AUG SEP OCT	CCK

R -09908   07961 MCMAHAN-O'CONNOR CONSTRUCTION $ 3,047,373.91(A)10-22-74(A) 185 WO *   US CO*
ST-69*H*   TYPE PLAIN CONC. PAVE.   08-09-76*   10 US
US 41   US 41 FROM NORTH EDGE OF BOSWELL TO   3,434,725.07(B)10-29-74(B)08-09-76*   15 4*
7.961 MI.   JUST SOUTH OF US 52.   1,674.40   02-05-77 06-13-77*   COMPLETE & ACCEPTED   20 0.0
   BENTON CO.   (C)11-04-74(C)06-21-77*   FINAL ESTIMATE PAID   25 100
   PE/S = KENNETH BROOKS   30
   PHONE = 317-884-1706   100-ST   35

B -09936   00062 WEDDLE BROTHERS CONSTRUCTION $ 440,668.25(A)04-22-75(A) 150 WO *   05 C86
ST-F-307(18)   TYPE STEEL BEAM   08-04-76*   10 SR
63-86-2096   SR 63 OVER PENN CENTRAL, 0.7 MI.   432,564.30(B)05-19-75(B)09-20-76*   15 63
SR 63   N. OF US 136.   03-19-77 02-01-77*   COMPLETE & ACCEPTED   20 0.0
0.002 MI.   WARREN CO.   (C)06-02-75(C)02-10-77*   FINAL ESTIMATE PAID   25 100
   PE/S = HAROLD CLUSSIN   30
   PHONE =   100-ST   35

R -09949   07962 RALPH FUGERS & CO. $ 5,921,008.62(A)12-17-74(A) 150 WO *   05 C66
ST-F-307(14)   TYPE PRE-GRADING   08-31-76*   10 SR
SR 63   SR 63 FROM 0.5 MI. N. OF US 136 TO   5,957,017.50(B)12-23-74(B)09-29-76*   15 63
7.962 MI.   1.5 MI. S. OF SR 28.   4,044.65   03-28-77 08-23-77*   COMPLETE & ACCEPTED   20 0.0
7.962 MI.   WARREN CO.   (C)01-14-75(C)09-01-77*   FINAL ESTIMATE PAID   25 100
   PE/S = MICHAEL WINK   30
   PHONE = 317-793-4272   100-ST   35

B -09960   00000 E. H. HUGHES CO. $ 30d,970.00(A)07-22-75(A)11-29-75*   05 M00
I-RF1-65-5(47)139   TYPE DECK REPAIR   07-21-76*   10 I-
I-65-139-2140J8   I-65 OVER PENN CENTRAL & PRAIRIE   296,396.58(B)08-15-75(B)08-10-76*   15 65
I-65   CREEK, N. OF LEBANON.   02-06-77 04-14-77*   COMPLETE & ACCEPTED   20 0.0
0.000 MI.   BOONE CO.   4,000.00(C)08-25-75(C)05-18-77*   FINAL ESTIMATE PAID   25 100
   PE/S = SEOAT GULEN   30
   PHONE =   93-F 10-ST   35

RM-09975   00000 STEEL ERECTION & PAINTING CO. $ 39,650.00(A)01-21-75(A) 90 WO *   05 M99
---------   TYPE BRIDGE PAINTING   09-29-76*   10 -
VARIOUS ROADS   PAINTING VARIOUS STRUCTURES CN US 41.   40,230.00(B)09-09-75(B)09-29-76*   15 VAR
0.000 MI.   US 52, I-65, SR 39, & SR 42.   13.03 03-28-77 04-21-77*   COMPLETE & ACCEPTED   20 0.0
   VARIOUS COS.   420.00(C)09-10-75(C)08-02-77*   FINAL ESTIMATE PAID   25 100
   PE/S = JOHN STIMAC   30
   PHONE =   100-ST   35

B -10073   00133 MICHAEL CONSTRUCTION CO. $ 170,151.00(A)04-22-75(A) 75 WO *   05 C06
RS-235(3)   TYPE R.C. SLAB   11-16-75*   10 SR
BCONE 9747   CO. RD. OVER BROWNS MCNOER CREEK   156,397.98(B)06-75(B)11-05-75*   15 CO
CO. RD.   IN MECHANICSBURG.   253.81 05-03-76 04-04-77*   COMPLETE & ACCEPTED   20 0.0
0.133 MI.   BOONE CO.   (C)06-23-75(C)04-11-77*   FINAL ESTIMATE PAID   25 100
   PE/S = ROBERT HUTCHINSON   30
   PHONE =   70-F 30-CO   35

Figure 2

SAMPLE CONTRACT DATA FROM THE INDIANA STATE HIGHWAY COMMISSION

The project engineers were coded as shown below:

Project Engineer Type	Code
City	1
County	2
State	3

The fact that there was a penalty on a contract is connoted by the number 1. The number 2 signified that there was no penalty.

The geographic districts were coded in the following manner:

Geographic District	Code
Crawfordsville	1
Fort Wayne	2
Greenfield	3
LaPorte	4
Seymour	5
Vincennes	6

The major reasons for penalties are coded as follows:

Reason	Code
No penalty	0
Project engineer turned in the Construction Record late	1
Late issuance of the Division of Materials and Tests certification	2
Project engineer turned in the Construction Record incomplete or with revisions required	3
Need the M-39 from the contractor	4
Need an approved IC 626 from the Central Office or the contractor	5

Reason	Code
Lengthy check in the district office	6
Late issuance of the District Office Materials' Laboratory certification	7
Late issuance of the supplemental IT 611's	8
Late receival of a sign certification letter	9
Lengthy processing by IBM	10
Delay at the Central Office	11
Late issuance of a core report	12
Contractor protesting work day charges or approval of extension time	13
Holding for laboratory numbers	14
Awaiting FHWA approval for a time extension	15
Awaiting IC 115 (Extra Work Agreement)	16
Miscellaneous or other	17

The year the contract payment procedure was completed was coded according to the last digit in the year. For example, the code for a contract completed and paid in 1976 is 6. It should be noted that this coding system would have to be altered slightly if the computer analysis was carried out in the 1980's due to the repetition of unit digits for each decade. The program is set up so that the year code can easily be changed into a two digit number by altering one format statement.

The actual computer program was written by the researchers in the Fortran language. It makes use of several "IF Statements" which facilitate the required branching that is needed to differentiate between the 1080 possible types of contracts. The general layout of the computer program can be seen in Figure 3 on the next page which is the Computer Program Flowchart. A copy of the actual computer program is illustrated in Appendix A.

Output for the computer program consists of a number of tables. The first table lists the contracts for the year in which a penalty occurred along with the actual penalty amount. At the bottom of this table is the total penalty amount paid by the State for the year. This first table is followed by five sets of tables, each of which contains data for a certain contract type. Each of these five sets of tables contains the following information for the year:

a) The percentage of contracts of a certain type in which a penalty was paid.

b) A breakdown by districts of the percentage of penalties paid for a certain contract type.

c) A breakdown by districts with respect to penalty percentages versus project engineer type for a certain type of contract.

d) The total penalty paid for a certain contract type.

e) A breakdown by districts of penalty amounts versus project engineer type for a certain type of contract.

f) A breakdown by project engineer type of the total penalty amounts paid for a certain type of contract.
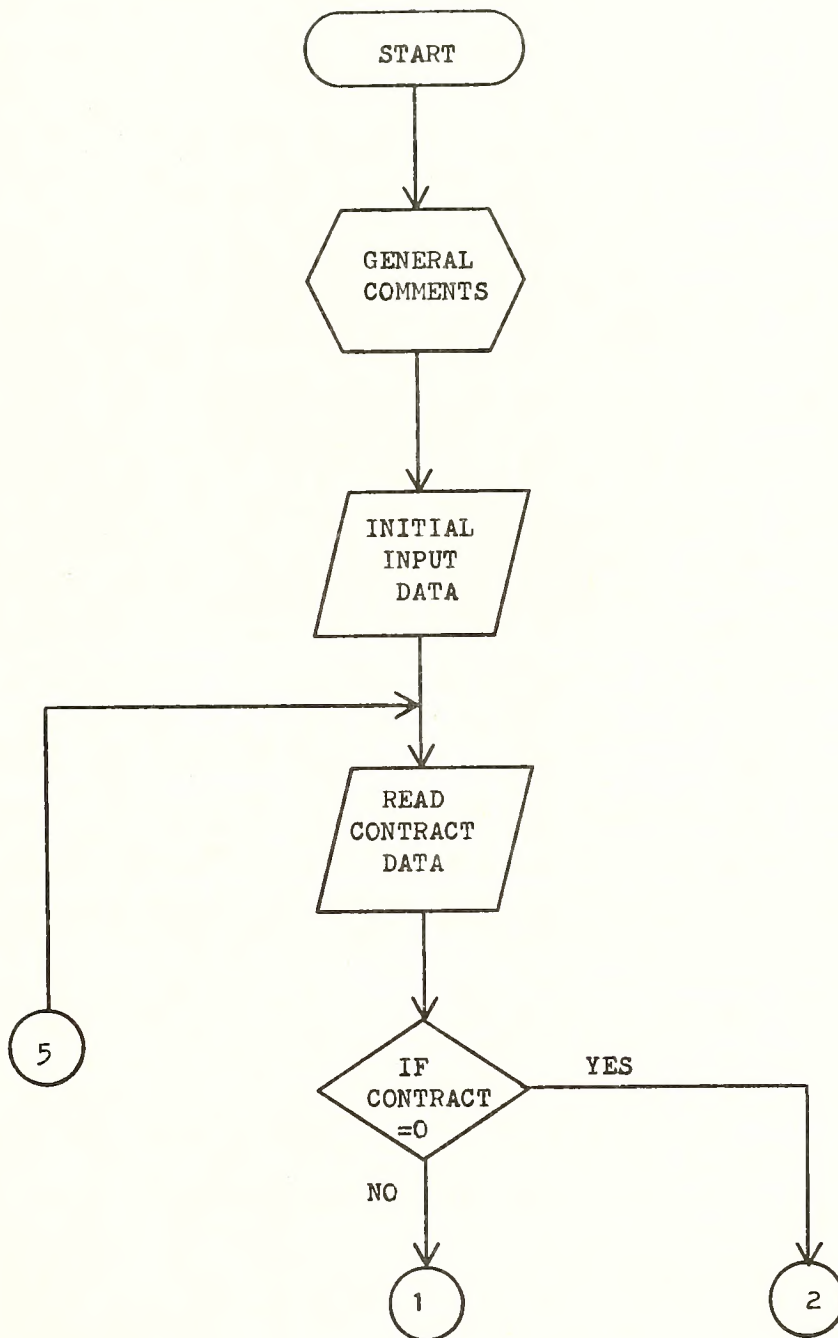
Figure 3

COMPUTER PROGRAM FLOWCHART
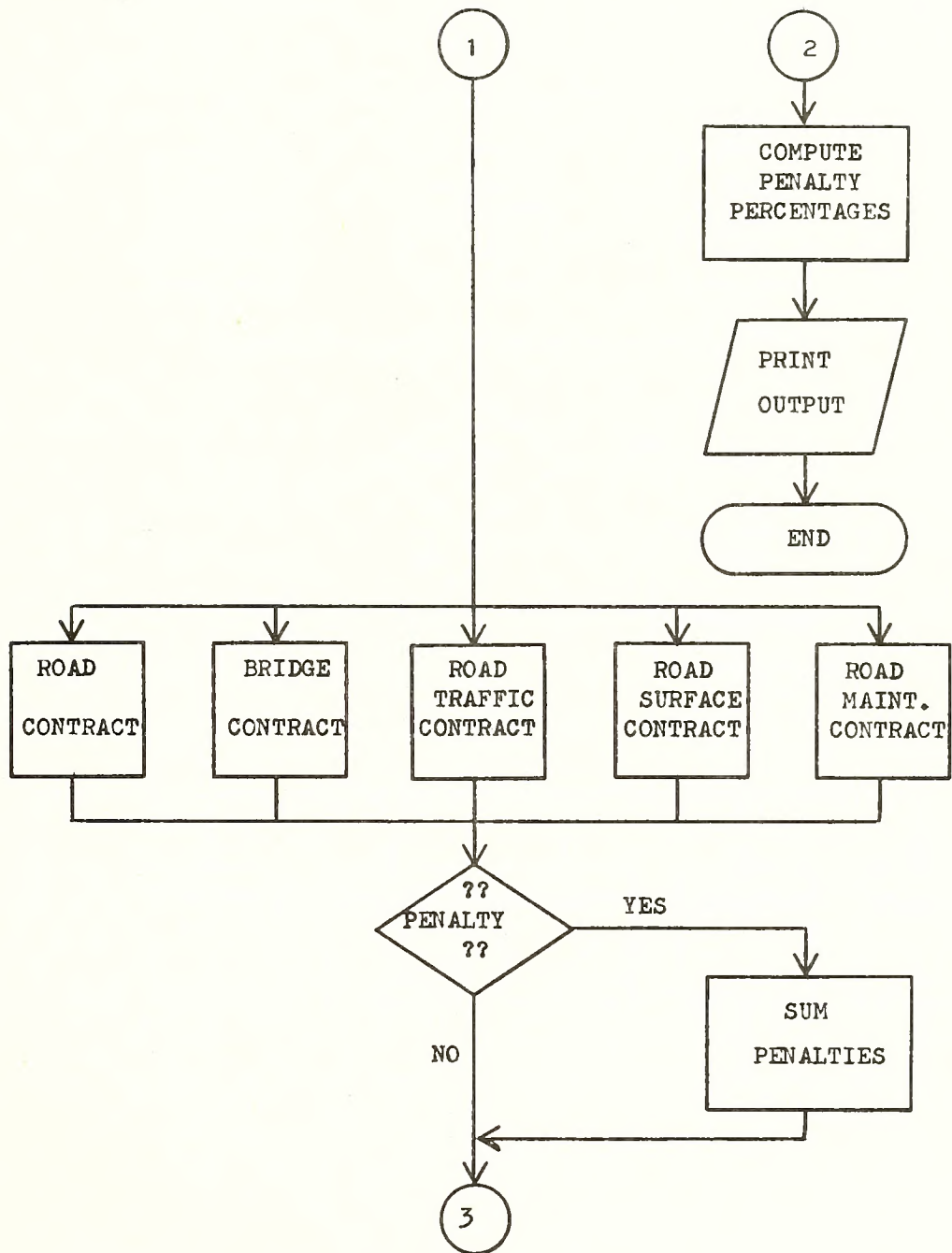
Figure 3, cont.
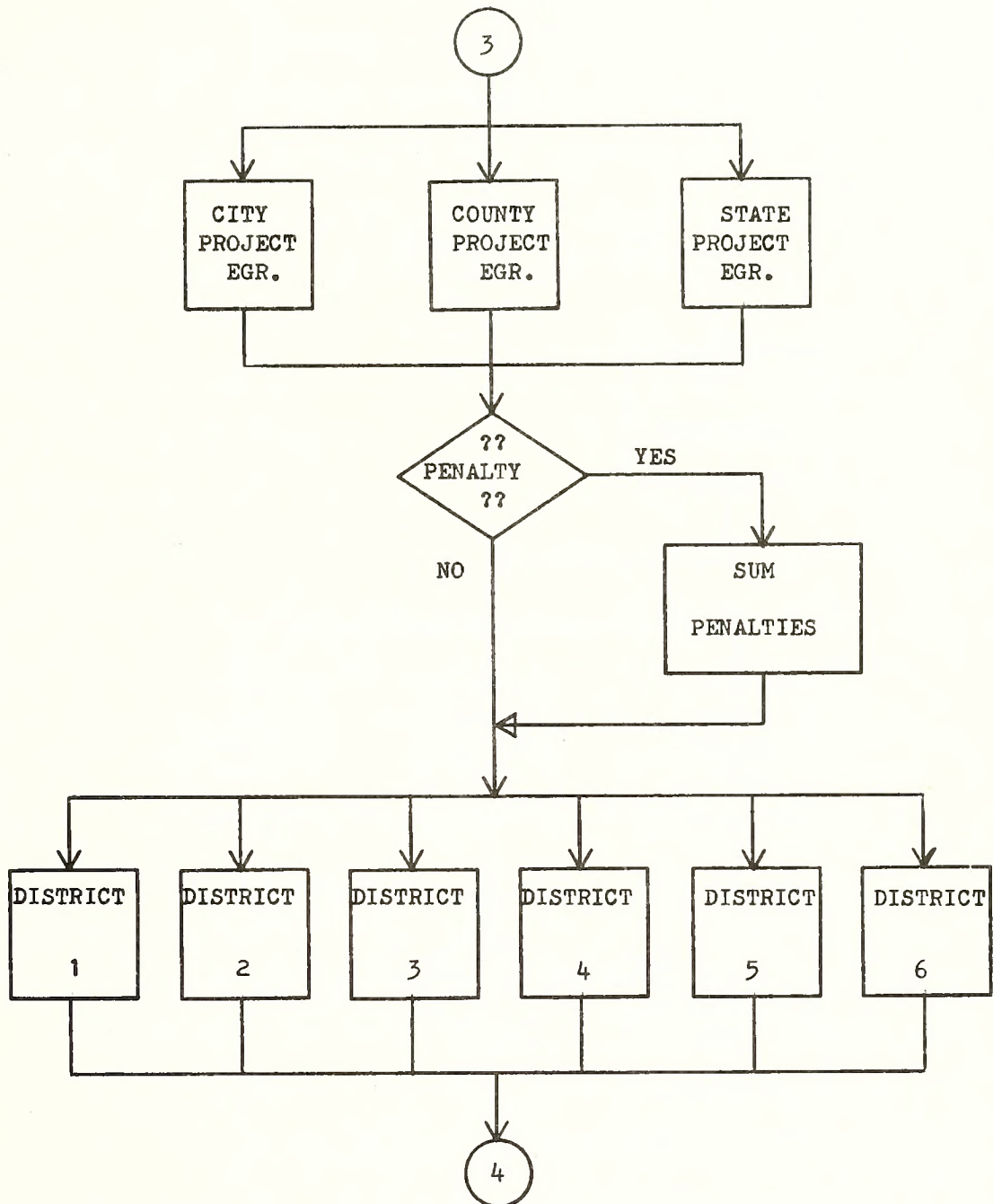
Figure 3, cont.
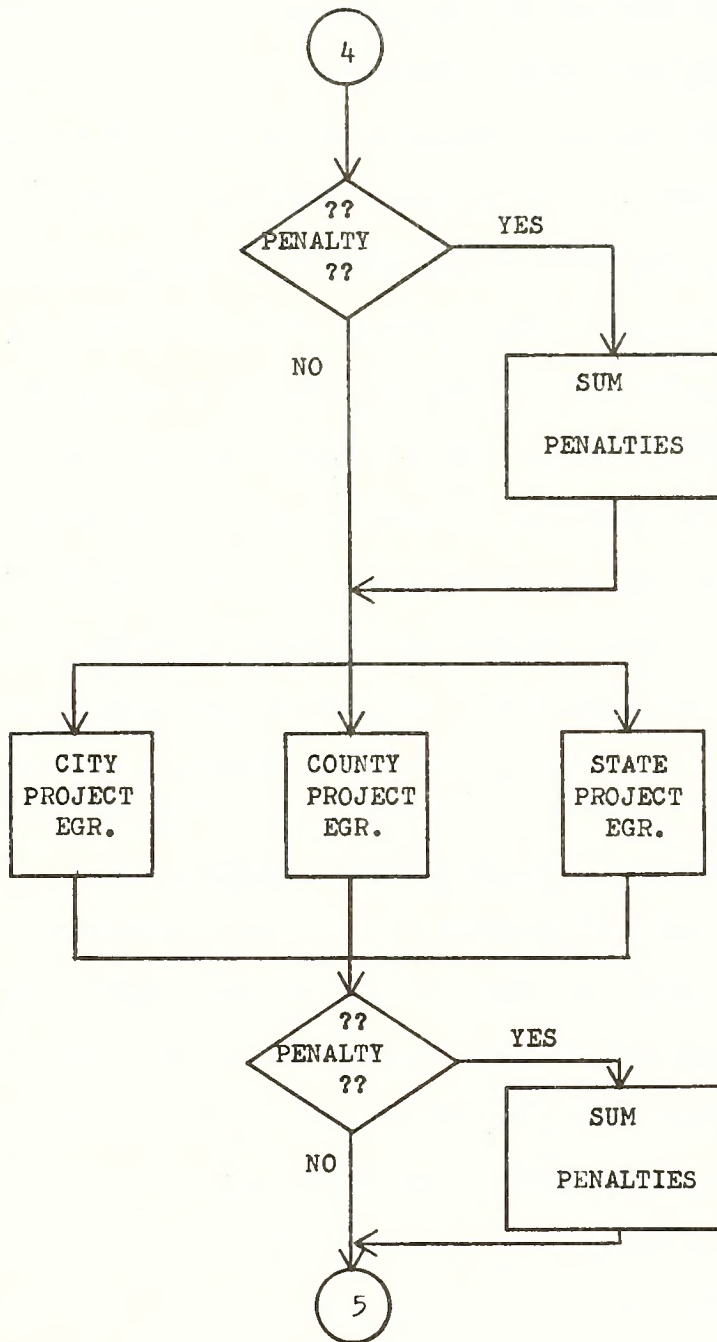
Figure 3, cont.

An example of the output is shown in Appendix B. This output is for the 1976 data and its content should be self explanatory.

The computer program that was developed for the data analysis greatly reduced the tedious job of tabulating data. The program was written so that it has to be run a separate time for each year of data. This allows for unlimited future use of the program by the State of Indiana except for a minor format alteration in later years for the contract year coding system. Also, the program provides for each data card to contain the required information for only one contract. This prevents mistakes in that contract data cannot be mixed up on cards as when two or more data points are on a single card. Finally, the program format was developed so that if future data divisions or methods of analysis are desired, they can be easily added by changing only a few cards. This versatility makes this computer program a valuable data analysis tool.

7.2 Penalty Breakdown by Year

One of the methods of analyzing the contract data was by contract year. The contract year is that year when the final payment was made to the contractor by the Indiana State Highway Commission whether an interest penalty occurred or not. The plot of Total Penalty versus Year can be seen in Figure 4. This figure clearly shows that from 1972 through 1977, the total penalty dollar amount increased dramatically. Also on this plot can be seen the increase in the number of contracts in which penalties occurred except for the same values in 1976 and 1977.
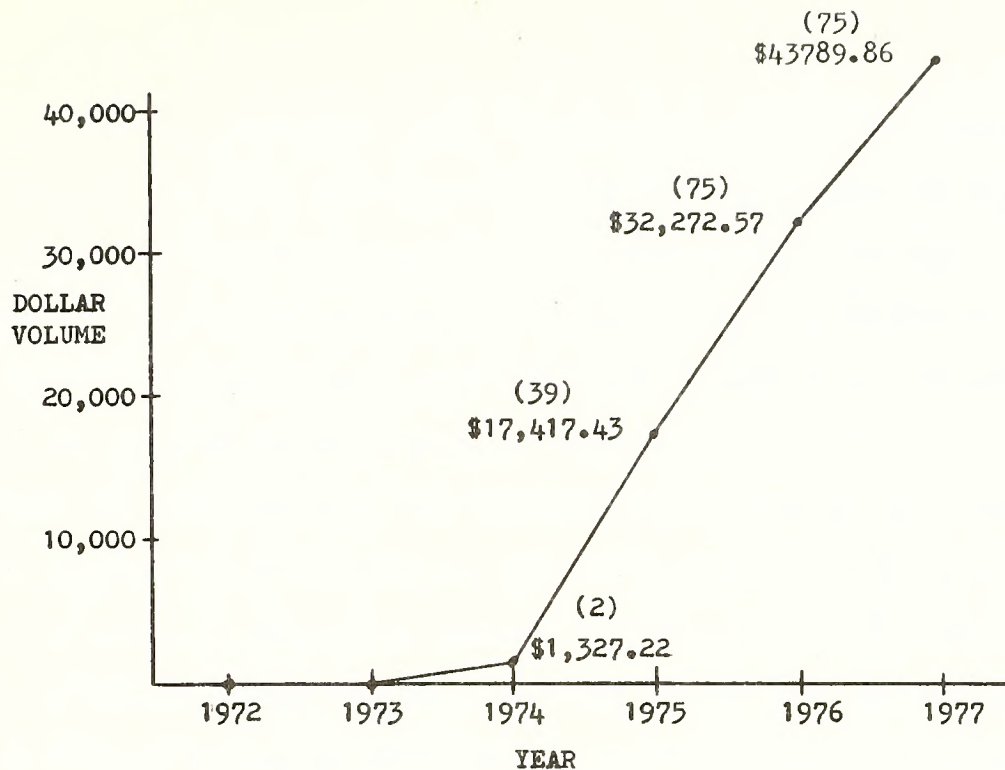
Figure 4

TOTAL PENALTY VERSUS YEAR

Table 2

PERCENT OF CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	119	0	0 %
1973	153	0	0 %
1974	163	2	1 %
1975	279	39	14 %
1976	355	75	21 %
1977	359	75	20 %

From the data compilation, it was known that from 1972 through 1977, the number of contracts let by the State of Indiana for highway related construction increased. Because of this, one might say that the increasing penalty amounts were due only to the increased number of contracts being performed; however, this is not the case. If one looks at the percentage of contracts in which penalties were paid each year with this percentage being based on the number of contracts in which penalties occurred divided by the total number of contracts in which final payments were made, it can be observed that this percentage increases from 1972 through 1976 and decreases by only one percent in 1977. Table 2, entitled Percent of Contracts With Penalties versus Year, shows this trend in penalty percentages. Therefore, the data shows that the State is paying fewer and fewer of its contracts on time.

The 1977 projections are based upon the following eight month data:

a) Total Penalty- $29193.24

b) Number of Contracts with Penalties- 50

c) Total Number of Contracts- 239

7.3 Penalty Breakdown by Contract Type

As was shown in the Computer Program Development section (7.1), there are five types of highway related construction contracts in the State of Indiana. They are the Road contract, the Bridge contract, the Road-Traffic contract, the Road-Surfacing contract, and the Road-Maintenance contract. An example of each along with its appropriate Indiana State Highway Commission coding symbol are as follows:

CONTRACT TYPE	CODING SYMBOL	EXAMPLE
Road	R	Continuous reinforced concrete paving on I-65
Bridge	B	Bridge erection over the Wabash River
Road-Traffic	RT	Installation of traffic signals in Lafayette, Indiana
Road-Surfacing	RS	Bituminous resurfacing on Route 38
Road-Maintenance	RM	Bridge painting in Tippecanoe county

When analyzing the 1972 through 1976 contract penalty data based on contract type, it again becomes apparent that the State of Indiana is making fewer final payments of its highway related contracts on time. Figures 5 through 9 are graphs of the total penalty for each contract type versus year. Tables 3 through 7 are tabulations of contract penalty percentage data for each type. It can be seen from the tables that the percentage of contracts up to 1976 in which penalties are being paid is increasing for each contract type except in Table 4 which pertains to Bridge contracts. This penalty percentage for bridges decreased slightly (2%) from 1975 to 1976. However, the other four contract types show a noticeable penalty percentage increase from year to year. The 1977 data, however, shows some improvement in that penalty dollar totals decreased for the Bridge, Road-Traffic, and Road-Maintenance contracts. Penalty percentages also decreased for the Road, Road-Traffic, Road Surfacing, and Road-Maintenance contracts.
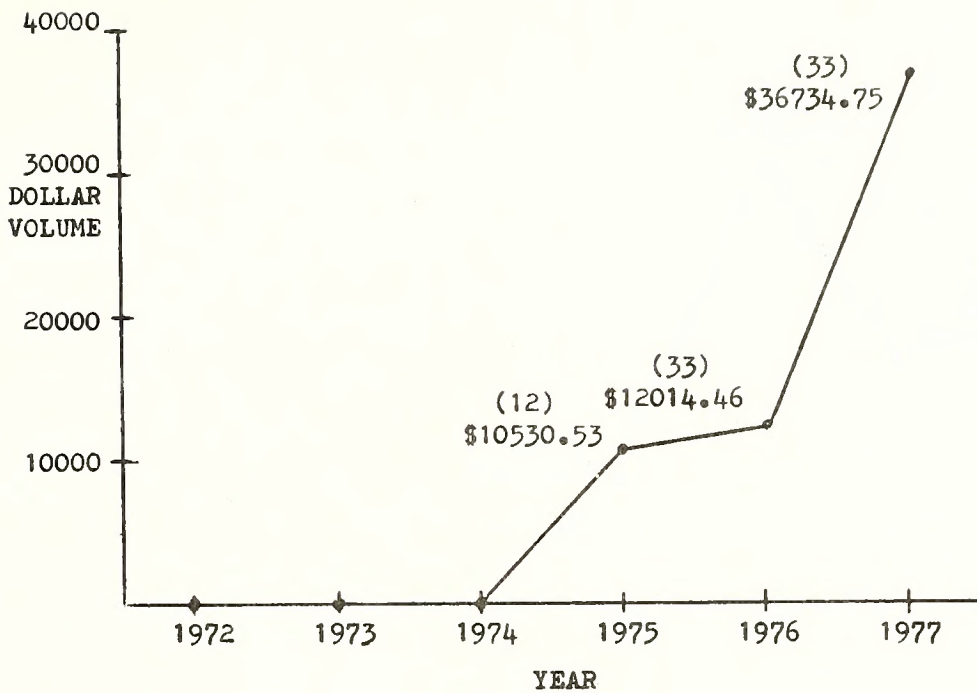
Figure 5

TOTAL ROAD PENALTY VERSUS YEAR

Table 3

PERCENT OF ROAD CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	60	0	0 %
1973	58	0	0 %
1974	52	0	0 %
1975	64	12	19 %
1976	94	33	35 %
1977	95	33	34 %
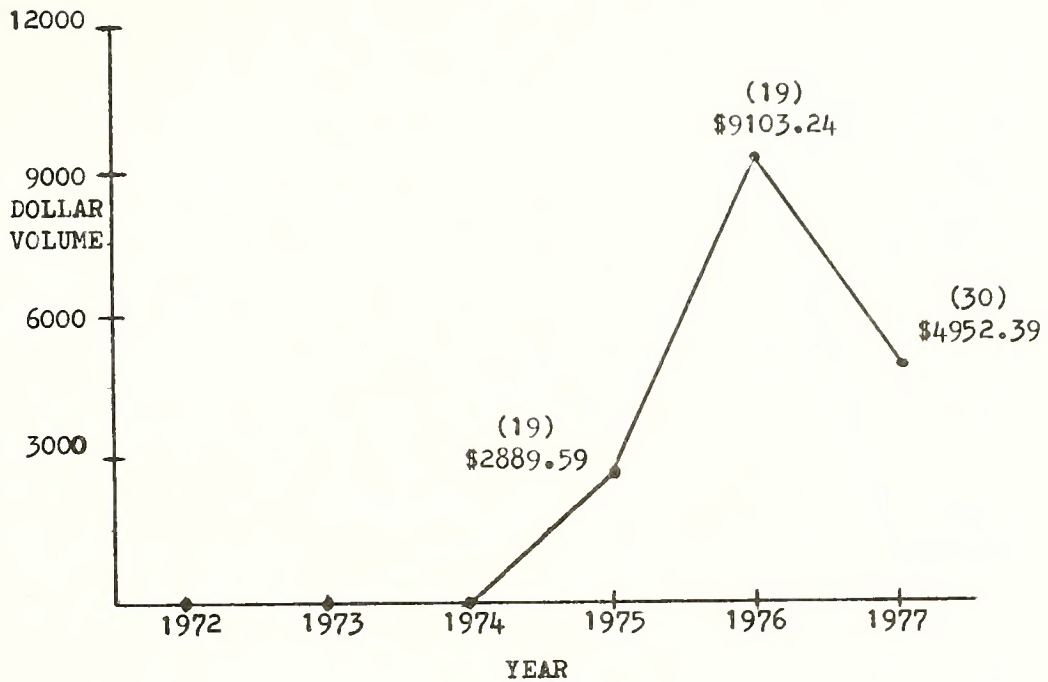
Figure 6

TOTAL BRIDGE PENALTY VERSUS YEAR

Table 4

PERCENT OF BRIDGE CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	54	0	0 %
1973	86	0	0 %
1974	68	0	0 %
1975	94	19	20 %
1976	107	19	18 %
1977	131	30	22 %
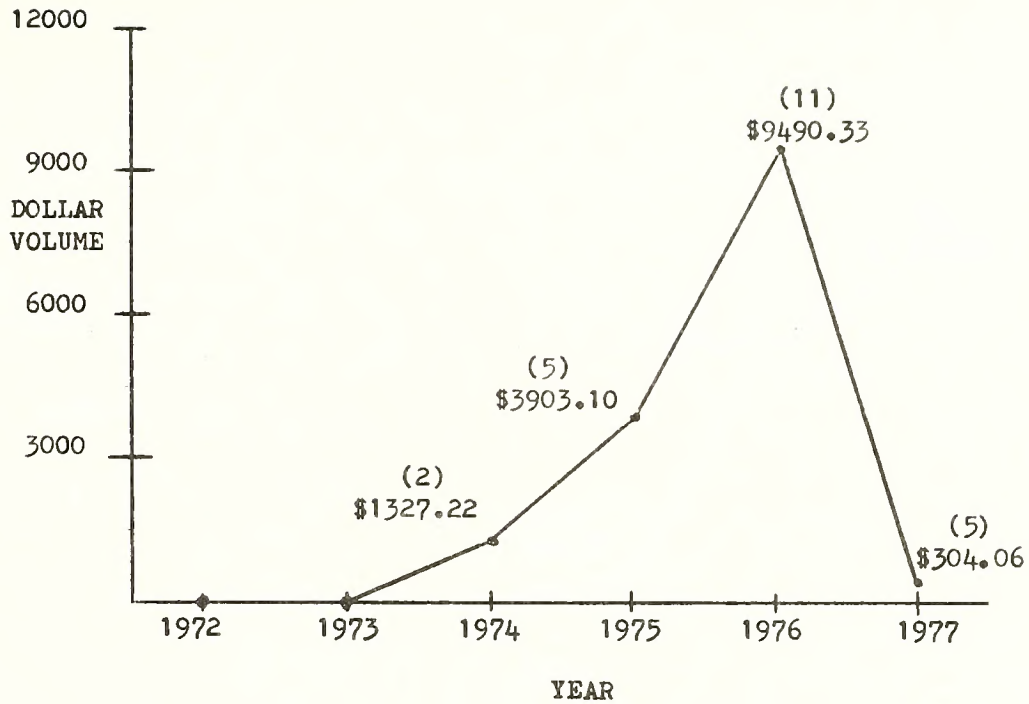
Figure 7

TOTAL ROAD*TRAFFIC PENALTY VERSUS YEAR

Table 5

PERCENT OF ROAD*TRAFFIC CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	5	0	0 %
1973	9	0	0 %
1974	17	2	12 %
1975	23	5	22 %
1976	36	11	31 %
1977	23	5	20 %
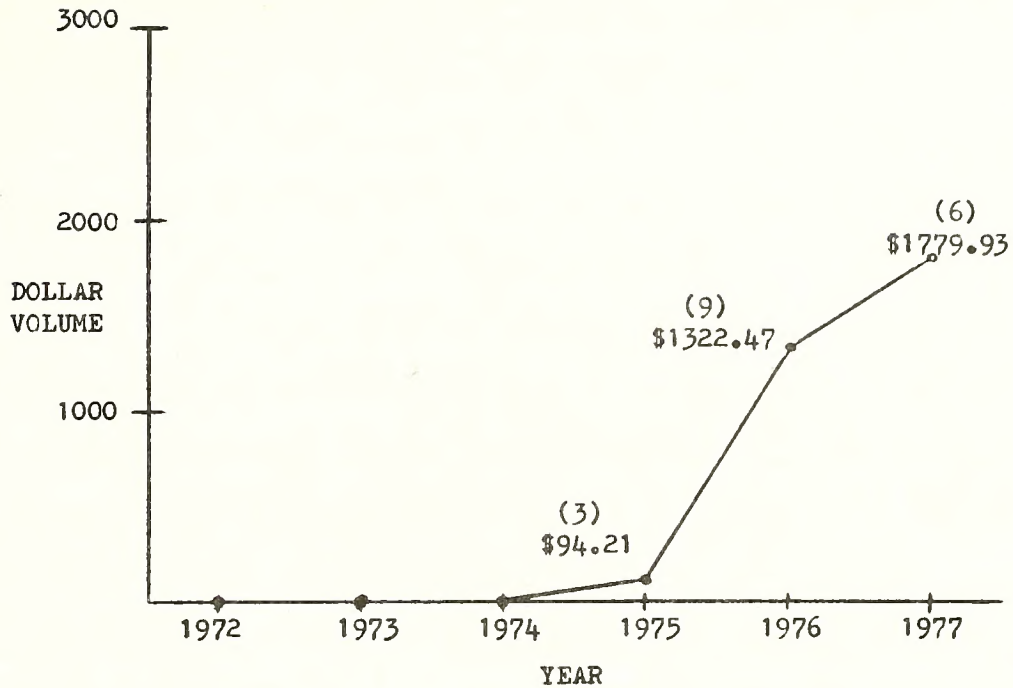
Figure 8

TOTAL ROAD*SURFACING PENALTY VERSUS YEAR

Table 6

PERCENT OF ROAD*SURFACING CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	0	0	0 %
1973	0	0	0 %
1974	23	0	0 %
1975	75	3	4 %
1976	76	9	12 %
1977	83	6	7 %
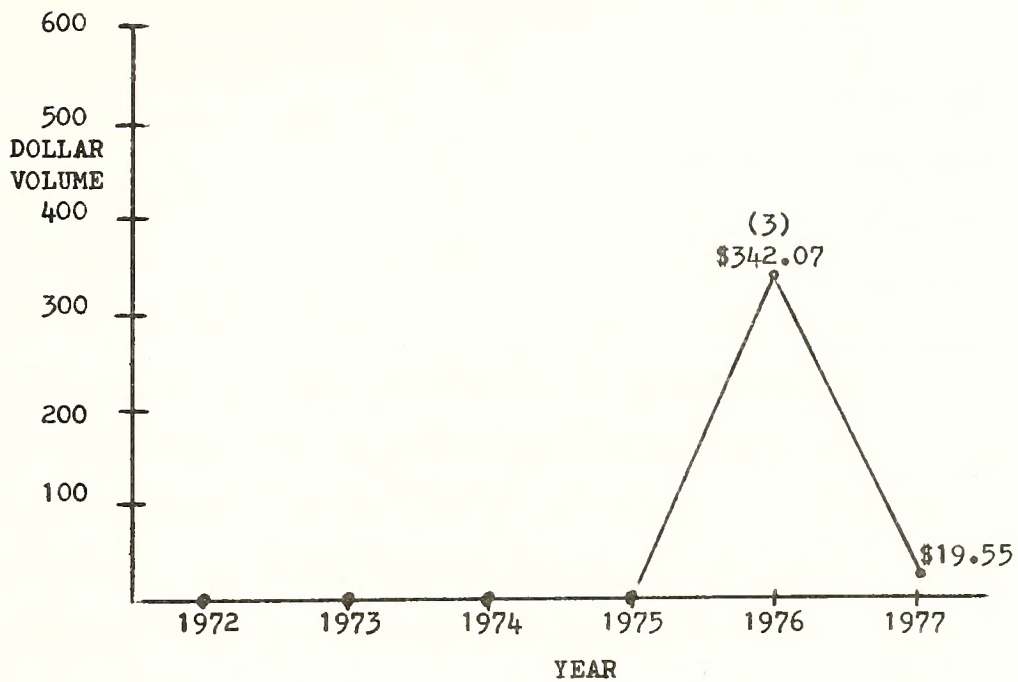
Figure 9

TOTAL ROAD*MAINTENANCE PENALTY VERSUS YEAR

Table 7

PERCENT OF ROAD*MAINTENANCE CONTRACTS WITH PENALTIES VERSUS YEAR

YEAR	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	0	0	0 %
1973	0	0	0 %
1974	3	0	0 %
1975	23	0	0 %
1976	42	3	7 %
1977	29	2	5 %

The tabulations also show that Road contracts provide the highest chance of an interest penalty occurring. This percentage (35% in 1976) for Road contracts is closely followed by the percentage for Road-Traffic contracts (31% in 1976). The 1977 data illustrates this high percentage for Road contracts but they are followed this time by Bridge contracts. The reason why the Road contract penalty percentage is the highest for all contract types should be apparent. Road contracts entail many more work items than the other four types of contracts. Therefore, the typical Road contract provides for more paperwork for the project engineer of the contract, which leads to more needed checking by both the District Review Officer and the material certification personnel. The data then bears out the feeling of the researchers and the Indiana State Highway Commission officers that the hardest type of highway related construction contract for which a final payment will be made to the contractor on time is the Road contract. This opinion is also supported when looking at Figures 5 through 9 for the 1972 through 1977 contract data. For 1975, 1976, and 1977, the Road contract penalty dollar totals are much greater than any of the other four types of contracts.

When looking at the five graphs, it should also be apparent that all are climbing from 1972 through 1976. This helps to reinforce the fact that things are getting worse for the final construction contract payment procedure. For 1977, three of the five show a fall but the sharp increase in Road contract penalties outweighs all of the decreases.

From the analysis of the contract data based on contract type
for 1972 through 1977, the researchers feel that project engineer
experience should be taken into account when assigning contracts.
It should be obvious that based on the difficulty of completing the
contract's Construction Record, the more experienced project engineer
should be given the Road contracts. The researchers feel that if the
project engineer is unable to complete the Construction Record on
time and satisfactorily, this insufficientness probably carries
over into his daily work. Another study of this type might be to
investigate the project engineer's ability to complete the Construction
Record on time with the final quality of his project. This type of
analysis might prove interesting to the State of Indiana.

The following eight month data is the basis for the 1977 projec-
tions shown on the tables and figures for the contract types:

a) Total Road contract penalty — $24489.83

b) Total Bridge contract penalty — $3301.59

c) Total Road-Traffic contract penalty — $202.17

d) Total Road-Surfacing contract penalty — $1186.62

e) Total Road-Maintenance contract penalty — $13.03

f) Total number of Road contracts — 63

g) Total number of Bridge contracts — 87

h) Total number of Road-Traffic contracts — 15

i) Total number of Road-Surfacing contracts — 55

j) Total number of Road-Maintenance contracts — 19

k) Total number of Road contracts with penalties — 22

l) Total number of Bridge contracts with penalties — 20

m) Total number of Road-Traffic contracts with   —   3

penalties

n) Total number of Road-Surfacing contracts with   —   4

penalties

o) Total number of Road-Maintenance contracts with   —   1

penalties

7.4 Penalty Breakdown by Contract Duration

Another way of analyzing the highway related contract data was

by contract duration. Contract duration is the number of working

days or calendar days that is allowed to the contractor by the State

of Indiana to complete his work. Most contracts are usually issued

on the work day basis due to holidays occurring during the anticipated

work span or the possibility of inclement weather during the project.

For this analysis, the researchers used the Indiana State Highway

Commission contractual data which contains both the contract letting

date and the number of working days allowed the contractor. A few

of the contracts gave a completion date instead of the number of

work days allowed but the number of work days between starting and

finishing can be easily converted from the calendar days. For this

analysis, considering Saturdays and Sundays but not considering

legal holidays, it is assumed that there are 260 working days in a

calendar year. Therefore, the contract duration breakdowns were by

130 working days which corresponds to six months of calendar days.

It should be remembered that only those contracts in which interest

penalties occurred were analyzed. Table 8 shows for each contract

Table 8

PENALTY TOTALS AND PERCENTAGES VERSUS CONTRACT DURATION

DURATION	YEAR			
	1974	1975	1976	1977
0-130 WD	$1327.22 (2) 100%	$9659.25 (24) 62%	$9015.26 (36) 48%	$8508.53 (35) 46%
131-260 WD	$0.00 (0) 0%	$7697.28 (14) 36%	$15064.12 (36) 48%	$32668.17 (30) 39%
261-390 WD	$0.00 (0) 0%	$60.90 (1) 3%	$879.43 (1) 1%	$1582.86 (8) 11%
391-520 WD	$0.00 (0) 0%	$0.00 (0) 0%	$0.00 (0) 0%	$1030.31 (3) 4%
521-650 WD	$0.00 (0) 0%	$0.00 (0) 0%	$7313.76 (2) 3%	$0.00 (0) 0%
$\geq$ 651 WD	$0.00 (0) 0%	$0.00 (0) 0%	$0.00 (0) 0%	$0.00 (0) 0%

NOTE: Data for 1972 and 1973 is not included on this table since no interest penalties occurred during those two years.

duration breakdown, the penalty total amount, number of contracts making up this amount, and percentage of the total number of contracts with penalties for the year.

For the 1974 through 1977 data, it can be seen from Table 8 that the short contracts, namely those equal to or less than one year in duration, make up the highest percentage of contracts with penalties. This seems to contradict what is normally believed by Indiana State Highway Commission officials. They feel and the researchers concur in this belief that the short contracts normally have fewer work items and as a result should have less paperwork for the Construction Record connected to them. Therefore, they should present a smaller chance for possible interest penalties. However, as can be seen from the data on Table 8, this belief is soundly contradicted. The only reason the researchers can come up with for this is that the State of Indiana lets a higher percentage of short duration contracts in comparison to long contracts and because of this, more of the contracts with penalties are of short duration.

To arrive at the 1977 data on Table 8, the following eight month data was used:

a) Number of 1977 penalty contracts   - 23
of 0-130 working days duration

b) Number of 1977 penalty contracts   - 20
of 131-260 working days duration

c) Number of 1977 penalty contracts   - 5
of 261-390 working days duration

d) Number of 1977 penalty contracts   - 2
of 391-520 working days duration

e) Number of 1977 penalty contracts   -   0
   of 521-650 working days duration

f) Number of 1977 penalty contracts of   -   0
   equal to or greater than 651 working
   days duration

g) Penalty total of 1977 contracts of   - $5672.35
   0-130 working days duration

h) Penalty total of 1977 contracts of   - $21778.78
   131-260 working days duration

i) Penalty total of 1977 contracts of   - $1055.24
   261-390 working days duration

j) Penalty total of 1977 contracts of   - $686.87
   391-520 working days duration

k) Penalty total of 1977 contracts of   - $0.00
   521-650 working days duration

l) Penalty total of 1977 contracts of   - $0.00
   equal to or greater than 651 working
   days duration

7.5 Penalty Breakdown by Geographic District

The next way the contractual data was analyzed was by geographic

district. As has been stated previously, the State of Indiana is

comprised of six highway districts. Each is run by a separate

district engineer and each has a District Review Officer who checks

the Construction Records and who tries to keep the interest penalties

as low as possible. Each district also performs all five types of

contracts. Therefore, the researchers thought it might be interesting

to compare districts as to their ability to pay the highway related

construction contracts on time.

The data was analyzed by district in three ways. They were

by penalty totals, by penalty percentage, and by the number of con-

struction personnel in the district. The results of the first two

methods will be discussed in the following two paragraphs and then they will be followed by the construction personnel analysis.

Tables 9 through 14 show for each geographic district its interest penalty total for each year along with its penalty percentage. The penalty percentage was calculated by dividing the number of contracts in which penalties occurred by the total number of contracts in which final payment was made during the year. As can be seen on Table 11, the Greenfield district has the highest penalty total along with the highest penalty percentage for each of the years 1975, 1976, and 1977. The other five districts are not even close in their penalty percentages when compared to the Greenfield district. Another interesting result of the six tables is that they show that the penalty percentages increased each year for every district until the 1977 data where all but the Seymour district decreased. Also, it should be pointed out that the LaPorte district was the best district in terms of low interest penalties and percentages up through 1976. It was beaten by 2% in 1977 by the Vincennes district. These six tables show that the State of Indiana ought to be investigating its personnel in the Greenfield district to see why and because of whom the inefficiencies occur.

The 1977 data for district total penalties and percentages is based on the eight month data listed below:

a) Penalty total in the Crawfordsville district − $9467.18

b) Penalty total in the Fort Wayne district − $11468.70

c) Penalty total in the Greenfield district − $3268.17

d) Penalty total in the LaPorte district − $1334.80

Table 9

CRAWFORDSVILLE DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	21	0	0%
1973	$0.00	28	0	0%
1974	$0.00	11	0	0%
1975	$560.63	48	7	15%
1976	$2996.25	43	12	28%
1977	$14200.77	56	15	27%

Table 10

FT. WAYNE DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	15	0	0%
1973	$0.00	19	0	0%
1974	$0.00	23	0	0%
1975	$2545.59	36	4	11%
1976	$2913.46	60	14	23%
1977	$17203.05	45	9	20%

Table 11

GREENFIELD DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	25	0	0%
1973	$0.00	35	0	0%
1974	$1259.31	25	1	4%
1975	$6526.66	56	14	25%
1976	$19366.54	57	24	42%
1977	$4902.26	89	29	32%

Table 12

LA PORTE DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	21	0	0%
1973	$0.00	21	0	0%
1974	$0.00	34	0	0%
1975	$64.30	34	2	6%
1976	$728.00	65	8	12%
1977	$2002.23	41	3	7%

Table 13

SEYMOUR DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	19	0	0%
1973	$0.00	33	0	0%
1974	$0.00	35	0	0%
1975	$6089.51	62	8	13%
1976	$4621.83	65	10	15%
1977	$5290.58	65	17	26%

Table 14

VINCENNES DISTRICT PENALTY TOTALS AND PERCENTAGES

YEAR	PENALTY TOTAL	TOTAL NUMBER	NUMBER WITH PENALTIES	PERCENTAGE
1972	$0.00	18	0	0%
1973	$0.00	17	0	0%
1974	$67.91	35	1	3%
1975	$1630.84	43	4	9%
1976	$1646.49	65	7	11%
1977	$190.98	65	3	5%

e) Penalty total in the Seymour district   - $3527.09

f) Penalty total in the Vincennes district   - $127.32

g) Total number of contracts paid and the   -   37,10
number with penalties in the Crawfordsville
district

h) Total number of contracts paid and the   -   30,6
number with penalties in the Fort Wayne
district

i) Total number of contracts paid and the   -   59,19
number with penalties in the Greenfield
district

j) Total number of contracts paid and the   -   27,2
number with penalties in the LaPorte
district

k) Total number of contracts paid and the   -   43,11
number with penalties in the Seymour
district

l) Total number of contracts paid and the   -   43,2
number with penalties in the Vincennes
district

The third way of analyzing the highway related construction
contract data by district is to consider the number of construction
personnel working for the district each year. The Indiana State
Highway Commission considers anyone with a Function 90 job code
as a member of its construction personnel. All six geographic districts
in the State of Indiana vary as to the number of construction per-
sonnel working in it. Indiana State Highway Commission officials
felt that there might be a correlation between the number of State
men working on the contracts and the total interest penalty for the
contracts. They thought that the districts with fewer construction
personnel would show the highest penalty amounts.

In order to investigate this opinion, the researchers had to get personnel data from the Indiana State Highway Commission's Personnel Office in Indianapolis. This office compiled the totals of all of the Function 90 personnel for each district for 1974, 1975, 1976, and up through August 31, 1977. This data can be seen on Tables 15 through 18.

Personnel data for 1972 and 1973 was not compiled since no penalties occurred those two years. Since all penalty totals for each district are based on the complete year, the researchers felt that it would be best to average the twelve monthly totals for each district to get a representative total for the year. These averages can be seen on the bottom row of each table.

In order to compare the geographic districts with respect to the number of construction men working in each district, the district interest penalty total for a year was divided by the average number of construction personnel working in that district during the year. The results of these calculations can be seen on Table 19. This table shows that in terms of dollars of interest penalty per construction man, the Greenfield district is the worst for years 1974 through 1976. This correlates with the data presented in the first part of this section. However, the Fort Wayne district is the worst in 1977 due to having a contract with an interest penalty over $10000. This data also disproves the opinion of the Indiana State Highway Commission officials that those districts with fewer construction men would show a higher interest penalty cost per man. As can be seen from the 1975 and 1976 data on Table 19, the LaPorte district had

Table 15

NUMBER OF EMPLOYEES IN CONSTRUCTION IN 1974

DISTRICT

	CRAWFORDSVILLE	FT. WAYNE	GREENFIELD	LA PORTE	SEYMOUR	VINCENNES
JAN	101	75	142	88	189	174
FEB	100	72	142	86	187	174
MAR	97	72	142	87	185	172
APR	94	71	142	87	183	165
MAY	97	74	154	83	179	172
JUNE	108	99	157	88	187	174
JULY	108	115	207	89	208	193
AUG	120	118	209	88	211	192
SEPT	94	80	156	82	172	150
OCT	99	85	157	76	169	148
NOV	103	88	159	75	168	161
DEC	101	84	157	74	167	150
AVG	102	86	160	84	184	169

Table 16

NUMBER OF EMPLOYEES IN CONSTRUCTION IN 1975

DISTRICT

	CRAWFORDSVILLE	FT. WAYNE	GREENFIELD	LAPORTE	SEYMOUR	VINCENNES
JAN	100	85	157	75	182	149
FEB	97	86	152	75	181	151
MAR	98	86	148	74	177	150
APR	102	87	148	74	175	151
MAY	114	88	181	73	178	179
JUNE	113	108	194	74	185	187
JULY	116	120	224	74	200	184
AUG	122	119	231	78	198	186
SEPT	102	86	165	73	170	145
OCT	113	85	163	73	170	148
NOV	113	85	165	73	170	149
DEC	114	84	168	75	176	156
AVG	109	93	175	74	180	161

Table 17

NUMBER OF EMPLOYEES IN CONSTRUCTION IN 1976

DISTRICT

	CRAWFORDSVILLE	FT. WAYNE	GREENFIELD	LA PORTE	SEYMOUR	VINCENNES
JAN	115	84	166	74	176	155
FEB	---	--	---	--	---	---
MAR	114	84	163	73	175	154
APR	111	84	164	74	174	155
MAY	115	87	183	74	176	195
JUNE	120	103	185	79	181	192
JULY	131	107	193	79	193	191
AUG	130	128	192	74	197	186
SEPT	116	86	165	74	165	152
OCT	115	86	162	74	163	151
NOV	115	86	157	74	164	151
DEC	125	86	151	75	162	151
AVG	119	93	171	75	175	167

Table 18

NUMBER OF EMPLOYEES IN CONSTRUCTION IN 1977

DISTRICT

	CRAWFORDSVILLE	FT. WAYNE	GREENFIELD	LA PORTE	SEYMOUR	VINCENNES
JAN	123	85	149	75	160	146
FEB	123	85	146	75	160	145
MAR	122	85	146	74	160	142
APR	121	85	144	73	156	143
MAY	120	84	142	72	157	141
JUNE	157	130	161	87	159	145
JULY	158	130	160	87	158	141
AUG	152	126	167	85	157	143
AVG	135	101	152	79	158	143

Table 19

INTEREST PENALTY DOLLARS PER CONSTRUCTION MAN

	1974	1975	1976	1977
CRAWFORDSVILLE	$0.00	$5.14	$25.18	$105.19
FT. WAYNE	$0.00	$27.37	$31.33	$170.33
GREENFIELD	$7.87	$37.30	$113.25	$32.25
LA PORTE	$0.00	$0.87	$9.71	$25.34
SEYMOUR	$0.00	$33.83	$26.41	$33.48
VINCENNES	$0.40	$10.13	$9.86	$1.34

the lowest interest penalty per man while it also had the lowest
average number of construction men working during the year. There-
fore, the data shows that a high number of construction personnel
does not lead to a low interest penalty average.

7.6 Penalty Breakdown by Project Engineer Type

Three types of project engineers participate in the final
construction contract payment procedure-- namely, city, county, and
state. Each is expected to complete a Construction Record for his
project. It was mentioned by several Indiana State Highway Com-
mission officers that they felt that their state project engineers
were doing a much better job of completing the Construction Record
on time in comparison to both city and county project engineers.
It should be explained here that the city and county project engineers
are not employed by the State of Indiana; they are supervising a
project built in their city or county for their city or county
government. Because of this, they usually have other duties to attend
to for the city or county while they are at the same time super-
vising a project. Also, since they do not supervise a project all
of the time, their experience in filling out Construction Records
would be naturally less than that of the State of Indiana project
engineer. With these thoughts in mind, the highway related contract
data was analyzed according to project engineer type.

Tables 20 through 23 are tabulations of project engineer penalty
percentages for 1974 through 1977. The two columns under each of
the three types of engineers signify the number of contracts with
penalties and the total number of contracts paid throughout the year.

Table 20

1974 PENALTY PERCENTAGES VERSUS PROJECT ENGINEER TYPE

CONTRACT	CITY		COUNTY		STATE	
TYPE	PENALTY	TOTAL	PENALTY	TOTAL	PENALTY	TOTAL
ROAD	0	0	0	3	0	49
BRIDGE	0	0	0	11	0	57
ROAD-TRAFFIC	2	9	0	0	0	8
ROAD-SURFACING	0	0	0	0	0	23
ROAD-MAINTENANCE	0	0	0	0	0	3
TOTALS	2	9	0	14	0	140
PERCENTAGE	22%		0%		0%	

Table 21

1975 PENALTY PERCENTAGES VERSUS PROJECT ENGINEER TYPE

CONTRACT	CITY		COUNTY		STATE	
TYPE	PENALTY	TOTAL	PENALTY	TOTAL	PENALTY	TOTAL
ROAD	0	0	1	4	11	60
BRIDGE	1	1	4	14	14	79
ROAD-TRAFFIC	1	13	0	0	4	10
ROAD-SURFACING	0	0	0	0	3	75
ROAD-MAINTENANCE	0	0	0	0	0	23
TOTALS	2	14	5	18	32	247
PERCENTAGE	14%		28%		13%	

Table 22

1976 PENALTY PERCENTAGES VERSUS PROJECT ENGINEER TYPE

CONTRACT TYPE	CITY PENALTY	TOTAL	COUNTY PENALTY	TOTAL	STATE PENALTY	TOTAL
ROAD	6	11	1	3	26	80
BRIDGE	0	0	4	19	15	88
ROAD-TRAFFIC	8	11	0	0	3	25
ROAD-SURFACING	0	0	0	0	9	76
ROAD-MAINTENANCE	0	0	0	0	3	42
TOTALS	14	22	5	22	56	311
PERCENTAGE	64%		23%		18%	

Table 23

1977 PENALTY PERCENTAGES VERSUS PROJECT ENGINEER TYPE

CONTRACT TYPE	CITY PENALTY	TOTAL	COUNTY PENALTY	TOTAL	STATE PENALTY	TOTAL
ROAD	3	6	5	5	26	84
BRIDGE	5	11	5	14	21	107
ROAD-TRAFFIC	3	5	0	0	2	18
ROAD-SURFACING	0	0	0	0	6	83
ROAD-MAINTENANCE	0	0	0	0	2	29
TOTALS	11	22	10	19	57	321
PERCENTAGE	50%		53%		18%	

At the bottom of each table are percentages which are the portion of the total number of contracts supervised by a certain project engineer type in which a penalty occurred. As can be seen for 1974, 1975, 1976, and 1977, the city and county project engineers caused a higher percentage of penalties than their State of Indiana counterparts. Therefore, the data agrees with the Indiana State Highway Commission officials' opinions. This data brings up again that it might be a good idea for the State of Indiana to have a meeting with its project engineers to discuss the proper procedure in filling out the Construction Record. It seems as though this could only lower the penalty percentages along with decreasing the penalty amount paid to the contractors each year.

Table 23 shows the projected 1977 project engineer penalty percentage data. It is based on the eight month data shown below:

a) Total number of city, county, and state project — 4,3,56
engineer Road contracts

b) Total number of city, county, and state project — 7,9,71
engineer Bridge contracts

c) Total number of city, county, and state project — 3,0,12
engineer Road-Traffic contracts

d) Total number of city, county, and state project — 0,0,55
engineer Road-Surfacing contracts

e) Total number of city, county, and state project — 0,0,19
engineer Road-Maintenance contracts

f) Number of city, county, and state project — 2,3,17
engineer Road contracts with penalties

g) Number of city, county, and state project — 3,3,14
engineer Bridge contracts with penalties

h) Number of city, county, and state project — 2,0,1
engineer Road-Traffic contracts with penalties

i) Number of city, county, and state project engineer Road-Surfacing contracts with penalties — 0,0,4

j) Number of city, county, and state project engineer Road-Maintenance contracts with penalties. — 0,0,1

7.7 Penalty History Analysis

Probably the most important section of the Data Analysis chapter is this one, the Penalty History Analysis. The discussions in the previous sections pointed out using numerical data that the State of Indiana does have a problem completing its final construction contract payment procedure within the 180 day limit and indicated where the problem areas lie. This section gives reasons for the late payment problems. It will show how the penalty reasons were analyzed, what the main reasons for interest penalties are, and will present a few suggestions on how to improve the procedure based on the penalty history analysis.

In order to look at the reasons for penalties, the first thing the researchers had to do was to look at all of the contracts in which final payments were made by the State of Indiana between the start of 1972 and August 31, 1977, and to group all of the contracts in which interest penalties occurred together. This was done using the contractual data supplied by the State of Indiana along with a history form devised by the researchers. For each contract in which an interest penalty was paid, the researchers compiled pertinent information about the contract in reference to reasons for the penalty on what the researchers call their History Analysis Form. A sample of this form can be seen in Figure 10. The data on this form

CONTRACT R-08744

1) Seymour district (Dearborn county)

2) Penalty amount= $1231.53

3) State project engineer

4) Contractor- Olinger Construction (Pre-grading)

5) Comments: a) Construction Record received in the Central Office 2 months and 28 days after the 180 day date.

b) 10-31-75 IC727: Construction Record not received in the district office.

c) 11-30-75 IC727: Construction Record not received in the district office.

d) 12-31-75 IC727: Construction Record not received in the district office. The retainage was also dropped from 5% to 1%.

e) 1-31-76 IC727: 50% checked by the district office.

f) 2-29-76 IC727: Need the M-39 from the contractor and the Division of Materials and Tests' certification.

g) 3-31-76 IC727: Need the Division of Materials and Tests' certification.

h) 4-30-76 IC727: Need the Division of Materials and Tests' certification.

Last Working Day- 8-25-75

Acceptance Date - 8-25-75

180 Day Date   - 2-21-76

Payment   - 6-8-76

Note: It took the project engineer approximately four months to get the Construction Record to the district office. Division of Materials and Tests' certification also contributed to the penalty. The retainage reduction saved a lot of money.

Figure 10

HISTORY ANALYSIS FORM

is for the State of Indiana contract R-08744 in which a penalty occurred and final payment was made to the contractor in 1976.

Data for this form is derived from two Indiana State Highway Commission sources. The first is the monthly computer printout illustrated in Figure 2 which shows information on contracts completed and paid during the year along with those contracts still in progress. This printout supplies the required information for the following sections of the History Analysis Form:

a) District and county the contract was performed in

b) Penalty amount

c) Type of project engineer

d) Contractor and type of contract

e) Last working day date

f) Acceptance date

g) 180 day date

h) Final payment date

The second information source is the IC 727 form which the Indiana State Highway Commission entitles the Road and Bridge Construction Record Status Report. It should be pointed out here that this report also covers the other three types of highway related construction contracts. The IC 727 is issued monthly and it lists the status of each contract that has been completed and accepted but has not had its final payment sent to the contractor. This form shows what part of the final construction contract payment procedure the contract is in, along with reasons why the process is still in progress. The IC 727 form is used to complete the Comments Section of the

History Analysis Form along with the Note Section at the bottom.

The Note Section on the History Analysis Form is used as a summary. The analyst looks at the reasons for penalties in the Comments Section and states the primary reason or reasons for the penalty in the Notes Section. This saves time when a later numerical analysis just looks at the primary penalty reason.

As can be seen from Figure 10, the R-08744 contract had a substantial penalty-- $1231.53. The two primary reasons for the penalty were that the project engineer turned the Construction Record into the District Office late, along with the late issuance of the Division of Materials and Tests certification. Also, it should be mentioned that a lot of money in interest penalties was saved by the State of Indiana on this contract when it dropped the contractor's retainage from 5% to 1%.

Every contract in which a penalty occurred since 1972 had a History Analysis Form filled out for it by the researchers. In doing this, it was noticed that there is a lack of uniformity on several of the items which make up the IC 727. These irregularities will be discussed separately in the following three paragraphs.

The first lack of uniformity is that of when the contract is first placed on the IC 727. In doing the history on each of the contracts with penalties, the researchers noticed that several of the contracts are not showing up on the IC 727 until a month or two before the 180 day payment period runs out. It seems as though it should be a mandatory requirement to put the contract on the IC 727 the month it is finally accepted. This would allow all

concerned to look at the IC 727 and know which accepted contracts have not been received in the District Office within one or two months after the start of the 180 day payment period. The responsible project engineer could then be notified of his lateness and fewer interest penalties should result.

The second lack of uniformity on the IC 727 deals with the Construction Record receipt in the District Office. A few of the districts show for each contract on the IC 727 the date the Construction Record was received in the District Office. This is a very good practice and should be a standard one throughout all six State of Indiana highway districts. By doing this routinely, it would be easy to determine which project engineers are submitting their Construction Records late. If it turns out to be a chronic problem for certain project engineers, then maybe it would be time to change personnel.

The third lack of uniformity pertains to penalty reasons. On several of the IC 727's, even though the contract is listed and the payment procedure is in progress, no note on its status was given. A monthly contract status update should be a requirement for all contracts. This would allow all personnel involved with the final construction contract payment procedure to discover the problems sooner and to take the necessary corrective actions to lower the amount of interest penalty paid to the contractor.

In completing the History Analysis Form for all of the contracts with penalties, several reasons for the contract penalties surfaced. The most prevalent reasons were listed in the Computer Program

Development section (7.1). This list of reasons contains four
which illustrate delays due to the contractor. They are as follows:

a)   Need the M-39 from the contractor

b)   Need an approved IC 626 from the Central Office or the
     contractor

c)   Late issuance of the supplemental IT 611's

d)   Contractor protesting work day charges or approval of
     extension time

No penalty is paid by the State of Indiana due to this time charged
to the contractor.

After completing the History Analysis Forms for all of the
contracts with penalties from 1972 through August 31, 1977, the
researchers were able to determine which reasons for contract pen-
alties are the most prevalent. Two assumptions were necessary to
complete this analysis; they are as follows:

1)   If the project engineer took greater than two months after
     the contract acceptance date to get the Construction Record
     to the District Office, he contributed to the interest
     penalty.

2)   If a reason shows up in the Comments Section of the History
     Analysis Form for two or more consecutive months, it con-
     tributed to the penalty.

With these two assumptions in mind, it should be realized that for
each penalty contract, there can be more than one reason for the
penalty. As will be seen on the penalty reason analysis data tables,
the penalty reason percentages will add up to greater than 100%.

This is due to some contracts having more than one penalty reason.

Tables 24, 25, and 26 are the penalty reason analysis tabulations for 1975, 1976, and 1977. Only those reasons showing up equal to or greater than 10% of the time are placed on the tables. Also, data for 1972, 1973, and 1974 is not analyzed due to so few contracts with penalties during those years. All three tables show that the two primary reasons for interest penalties are project engineer lateness and late issuance of the Division of Materials and Tests certification. However, it should be stated that the tabulated percentages for these two reasons might actually be a little high. This is because both reasons sometimes involve extenuating circumstances. First, the project engineer is sometimes immediately sent to another job without time to adequately complete the Construction Record on the project he just completed. He then has to try to complete it while at the same time begin his new job. Secondly, sometimes when the Division of Materials and Tests is listed as not issuing its certification, it is waiting on an answer to a discrepancy letter or a material certification from the district. Therefore, these two excuses help to lower the penalty percentages somewhat but the fact still remains that project engineer lateness and the Division of Materials and Tests are the two main reasons for contract penalties up to now.

7.8 Liquidated Damages Analysis

This final section of the Data Analysis chapter is different from those previously explained. The others showed where the State of Indiana's problems were in the final construction contract payment

Table 24

1975 PENALTY REASON ANALYSIS

REASON FOR THE PENALTY	PERCENTAGE OF OCCURRENCES
Project engineer turned in the Construction Record late	69%
Late issuance of the Division of Materials and Tests' certification	46%
Need the M-39 from the contractor	10%
Need an approved IC 626 from the Central office or the contractor	10%

Table 25

1976 PENALTY REASON ANALYSIS

REASON FOR THE PENALTY	PERCENTAGE OF OCCURRENCES
Project engineer turned in the Construction Record late	57%
Late issuance of the Division of Materials and Tests' certification	44%
Need the M-39 from the contractor	16%

Table 26

1977 PENALTY REASON ANALYSIS

REASON FOR THE PENALTY	PERCENTAGE OF OCCURRENCES
Late issuance of the Division of Materials and Tests' certification	60%
Project engineer turned in the Construction Record late	54%
Late issuance of the District Office Materials' Certification	34%
Need M-39 from the contractor	16%
Project engineer turned in the Construction Record incomplete or with revisions required	14%
Late issuance of supplemental IT 611's	12%
Lengthy check in the district office	10%

procedure in terms of contract type, contract duration, geographic

district, or project engineer type. Liquidated damages are problems

to the contractor, not the State of Indiana. A liquidated damage

is that charge the contractor has to pay to the State of Indiana

for completing the contract late. It is usually based on a charge

per day late basis and this charge is multiplied by the number of

days late to get the total amount of liquidated damages due the

State of Indiana.

The researchers felt that it might be interesting to compare

the liquidated damages received from the contractor to the interest

penalties paid out to him for each year. This data can be seen in

Figure 11. Below the figure is Table 27 which shows the total amount

of liquidated damages for each year, the total number of contracts

making up this total, and the average liquidated damage total for

each year. The dark portion on Figure 11 pertains to total penalties.

As can be easily seen on Figure 11, the amount of liquidated

damages paid by the contractor each year to the State of Indiana

greatly exceeds the interest penalties expended. One could say

therefore that interest penalties are not a serious problem to con-

sider since the liquidated damages more than cancel them out. This

opinion is wrong; the State of Indiana cannot depend on the contractor

being late in his contract completion in order to pay for its inter-

est penalties. Liquidated damages are good in that they provide

extra revenue for the State of Indiana; however, they are bad in that

the project is delayed and it might be more beneficial to the State

of Indiana to have the project done sooner rather than becoming

richer while the project sits unfinished.

$200,000 —

$100,000 —

$17935 $37580 $191535 $213011 $161450 $183840

1972   1973   1974   1975   1976   1977

YEAR

Note: The dark portion pertains to the total penalty.

Figure 11
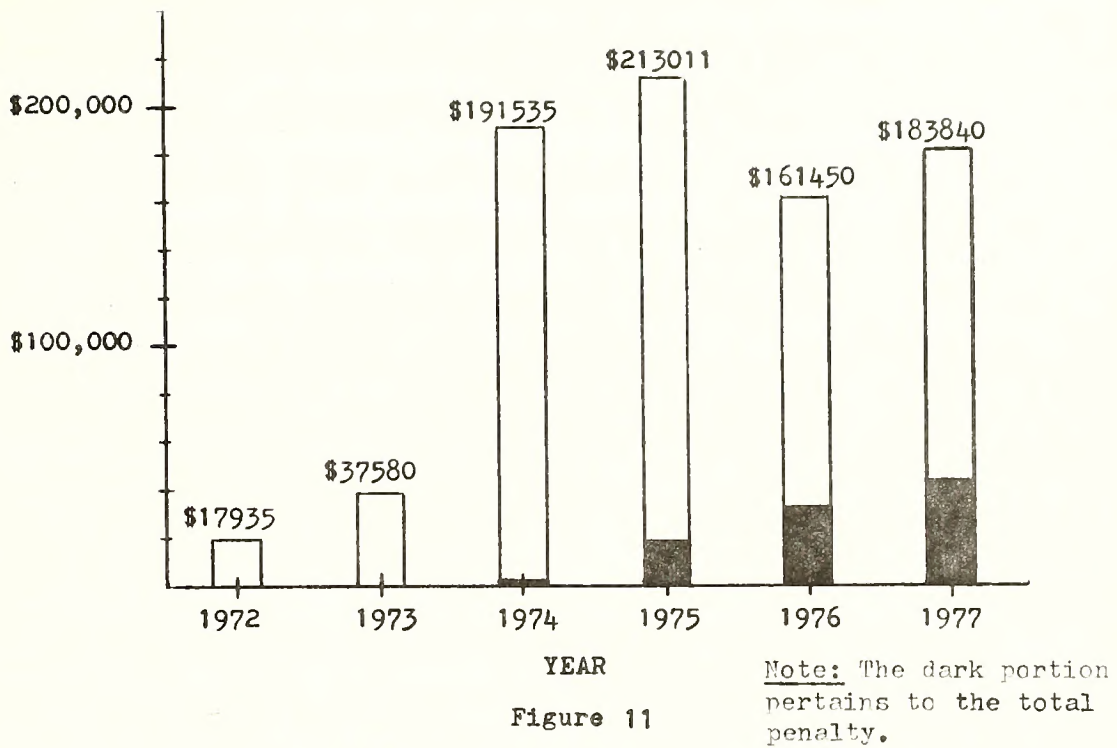
LIQUIDATED DAMAGES VERSUS TOTAL PENALTY BAR CHART

Table 27

LIQUIDATED DAMAGES VERSUS YEAR

YEAR	TOTAL	NUMBER	AVERAGE
1972	$17935	13	$1379.62
1973	$37580	23	$1633.91
1974	$191535	36	$5320.42
1975	$213011	50	$4260.22
1976	$161450	36	$4484.72
1977	$183840	44	$4178.18

The 1977 liquidated damages data are projections founded upon the following eight month data:

a) Total liquidated damages in 1977   - $122560

b) Number of contracts making up the   -   29
liquidated damages in 1977

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

The following three sections list the researchers' conclusions and recommendations pertaining to the final construction contract payment procedure and the Construction Record Guide.

8.1 Conclusions

The primary objective of this research paper was to provide an analysis of the final construction contract payment procedure of the Indiana State Highway Commission in order to give reasons, backed up by contract data, why the State of Indiana is having trouble paying its highway construction contracts on time. To carry out this analysis, the researcher had to investigate all of the components which make up the procedure. These are as follows: computation of final work item quantities using the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts, completion of the Construction Record by the project engineer with these final work item quantities, checking of the Construction Record by the District Review Officer, and issuance of the materials' certifications. Another major aspect of the analysis was the compilation of highway construction contract data from 1972 through August 31, 1977. The data gathering provided proof that the State of Indiana does have difficulty paying its contracts on time and indicates how bad the problem actually is.

The major conclusion of the research is that the problem of late payment deals mainly with two groups of men who work for the State of Indiana. The first of these are the project engineers. Contract data shows that through the habits of some to put off the necessary paperwork related to the final construction contract payment procedure, the final payments due the contractor are paid late which results in a substantial yearly interest penalty. The second group to contribute to the difficulty of paying contracts on time is the personnel at the Division of Materials and Tests. Their cyclical organizational structure of paperwork flow has added many dollars to the interest penalty amount. However, they have in the past few months changed this organizational structure to a more hierarchical one, but it is too early for the data to show that the interest penalties will be decreasing because of this needed alteration.

This research paper's recommendations of how the final construction contract payment procedure can be improved along with those on improving the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts can be found in the following two sections. They summarize both the opinions of the researchers along with the many District Review Officers and project engineers who were interviewed throughout the State of Indiana.

From the Data Analysis chapter, one can see that in terms of penalty dollars, the late payment problem has gotten worse every year. However, in terms of the percentage of contracts in which penalties were paid, there was an improvement as shown on the projected data for 1977.

Finally, it should be stated that the researchers feel that this area of interest penalties is a very important aspect of contractual interactions between the contractors and the State of Indiana. It has been said that the $44,000 to be paid out in interest penalties this year is negligible when compared to the several millions the contracts were worth. However, a more important issue than money is at stake here. One's goal in construction is to provide the best project at the lowest possible cost. The Construction Record is the primary responsibility of the project engineer. A project engineer who neglects his paperwork and causes a penalty to be paid to the contractor is not only increasing the project's final cost, he is also costing the State in terms of time where he could be starting another job rather than finishing up his late paperwork. To strive to do one's best at something is admittedly much harder than to accept something less. However, to carry out inferior project management techniques, as do many of the project engineers, leads to a poor quality project at a high cost. Therefore, additional monitoring in this interest penalty area should be carried out in the future. The interest penalty total along with the appropriate reasons for penalties provide an excellent barometer of the quality of work being carried out in the State of Indiana and of the quality of its personnel.

8.2 Recommendation Summary Pertaining to the Final Construction

Contract Payment Procedure

The following is a compilation of the researchers' recommendations in reference to the final construction contract payment procedure of the Indiana State Highway Commission; all are elaborated upon in the text of this research paper. It is felt that using any or all of the recommendations will result in increased efficiency in the final construction contract payment procedure.

1) Institute a standard policy of District Review Officers issuing preliminary quantity IC 642's to the material certification laboratories only for problem work items (e.g. those with disputed quantities or those taking a long time to calculate).

2) Stop the practice of issuing Contractor's Inspection of the Final Construction Record Report (M-39) forms to the contractor prior to receipt of both material certifications.

3) Require all project engineers including city and county to attend periodic workshops on the preparation of Construction Records taught by District Review Officers.

4) Allow only the District Review Officer and a field-experienced assistant to check the Construction Records.

5) Set up an annual meeting between the six District Review Officers so they can discuss their problems and prevent procedural divergence.

6) Notify project engineers that the Recommended

Change in Plans, Materials, or Quantities (IC 626) forms
can be completed by them with estimated quantities.

7) Allow District Review Officers to initiate retainage
reductions.

8) Assign all project engineers an office assistant to help
in the preparation of the Construction Record.

9) Encourage the Construction Record to be checked in sections
throughout the job.

10) Work up a job description for the District Review Officers.

11) Require the project engineer to prepare his own Material
Record (IT 611) forms each month in order to check the
contractor.

12) Require all District Review Officers to be field-experienced
and graduate civil engineers.

13) Stop the two distribution cycles at the Division of
Materials and Tests by giving the Assistant to the Office
Engineer a subordinate and let them do all of the material
certification checking.

14) Require only a Division of Materials and Tests certification
instead of also requiring the District Office Materials'
Laboratory certification.

15) Require that all manufacturer's certifications be checked
by the Division of Materials and Tests.

16) Computerize the checking procedure at the Division of
Materials and Tests.

17) Require a contract completed during a month to be listed

on the next month's IC 727 form.

18) Require that the date the Construction Record arrives in the District Office is listed beside the contract on the IC 727 form.

19) Require that the status of each completed contract be listed for every month a contract is on the IC 727 form.

8.3 Recommendation Summary Pertaining to the Construction Record Guide

Throughout the text of this research paper are recommendations which propose to improve the Indiana State Highway Commission 1970 Construction Record Guide for Road, Bridge, Maintenance, and Traffic Contracts. They were derived in order to aid the project engineer's preparation of the Construction Record along with facilitating the checking of it by the District Review Officer. The recommendations are compiled in this section to provide for easier reference. Therefore, the following recommendations developed from the research study pertain to the Construction Record Guide:

1) Make the corrections to the Construction Record Guide shown on the errata sheets in Appendix C.

2) Require the project engineers to reference their field book sketches more frequently rather than recopying them onto IC 614 forms.

3) Add a new section for Bridge Deck Repair Items.

4) Require all calculations to be carried out in work item quantities. This would remove the need for three forms of calculation accuracies.

5) In reference to contracts with federal funding, include a new section or incorporate Supplemental Instructions to Field Employees-No. 18 into the Construction Record Guide to show the project engineers how to handle this type of contract.

6) Do not require the usage of the IC 612B Pipe and Concrete Structures form if the same information it summarizes can be easily referenced in the project engineer's field book.

7) Computerize the dirt quantity calculations statewide. However, provide the District Review Officers with as-built cross section drawings so they can check the computer printout.

8) Do not require the usage of the IC 611A Pavement form if the same information it summarizes can be easily referenced in the project engineer's field book.

9) Place the new IC 654 Record of Construction (Concrete) form in the Construction Record Guide along with instructions of how it should be filled out.

10) Provide a work item example for Unclassified Excavation.

11) Provide a section in the Construction Record Guide showing the Central Office's opinion of the order of work items and forms to be included in the Construction Record.

LIST OF REFERENCES

LIST OF REFERENCES

Indiana State Highway Commission. 1970 Construction Record Guide
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Employees-Division of Construction, 1970.

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Manual for Frequency of Sampling & Testing and Basis for Use
of Materials, April 1974.

Indiana State Highway Commission. Standard Specifications, 1974.

APPENDICES

Appendix A

Appendix A

COMPUTER PROGRAM

```
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THIS PROGRAM WAS WRITTEN BY DAVID L. MAYS FOR HIS MASTERS
C       THESIS ENTITLED *AN INVESTIGATION OF THE FINAL CONSTRUCTION
C       CONTRACT PAYMENT PROCEDURE FOR THE INDIANA STATE HIGHWAY
C       COMMISSION.*  THE PROGRAM PROVIDES FOR A STATISTICAL ANALYSIS
C       OF ALL HIGHWAY CONTRACTS FROM JANUARY 1972 TO THE PRESENT.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE EXPRESSION PERTAINING TO CONTRACT NAMES WILL BE C.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE FOLLOWING ARE THE 5 TYPES OF INDIANA HIGHWAY CONTRACTS**
C                   1 R***ROAD
C                   2 B***BRIDGE
C                   3RT***ROAD*TRAFFIC
C                   4RS***ROAD*SURFACING
C                   5RM***ROAD*MAINTENANCE
C       THE EXPRESSION PERTAINING TO THE CONTRACT TYPES WILL BE IT.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE FOLLOWING ARE THE 3 TYPES OF INDIANA HIGHWAY CONTRACTS
C       PERTAINING TO WHOSE ENGINEER IS IN CHARGE OF THE JOB**
C                   1***CITY
C                   2***COUNTY
C                   3***STATE
C       THE EXPRESSION PERTAINING TO THESE THREE TYPES WILL BE ICE.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE EXPRESSION PERTAINING TO PENALTIES (INTEREST) WILL BE IP.
C       THE DESIGNATION WILL BE AS FOLLOWS**
C                   1***PENALTY WAS PAID
C                   2***PENALTY WAS NOT REQUIRED
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE EXPRESSION PERTAINING TO THE PENALTY AMOUNT WILL BE PA.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE FOLLOWING ARE THE 6 HIGHWAY DISTRICTS FOR INDIANA**
C                   1***CRAWFORDSVILLE
C                   2***FORT WAYNE
C                   3***GREENFIELD
C                   4***LA PORTE
C                   5***SEYMOUR
C                   6***VINCENNES
C       THE EXPRESSION PERTAINING TO THE DISTRICTS WILL BE ID.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
C       THE FOLLOWING ARE POSSIBLE REASONS FOR PENALTIES**
C                   0***NO PENALTY
C                   1***PROJECT ENGINEER TURNED IN THE DOCUMENTS LATE
C                   2***LATE ISSUANCE OF THE CENTRAL OFFICE MATERIAL
C                       CERTIFICATION
C                   3***PROJECT ENGINEER TURNED IN THE DOCUMENTS
C                       INCOMPLETE OR WITH REVISIONS REQUIRED
C                   4***NEEDED THE M*39 FROM THE CONTRACTOR
C                   5***NEED AN APPROVED IC 626 FROM THE CENTRAL OFFICE
C                       OR THE CONTRACTOR
C                   6***LENGTHY CHECK IN THE DISTRICT OFFICE
C                   7***LATE ISSUANCE OF THE DISTRICT OFFICE MATERIAL
C                       CERTIFICATION
C                   8***LATE ISSUANCE OF THE SUPPLEMENTAL IT 611#S
C                   9***LATE RECEIVAL OF A SIGN CERTIFICATION LETTER
C                   10***LENGTHY PROCESSING BY IBM
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C                  11***DELAY AT THE CENTRAL OFFICE (INDIANAPOLIS)
C                  12***LATE ISSUANCE OF A CORE REPORT
C                  13***CONTRACTOR PROTESTING WORK DAY CHARGES OR
C                       APPROVAL OF EXTENSION TIME
C                  14***HOLDING FOR LAB NUMBERS
C                  15***AWAITING FHWA APPROVAL FOR A TIME EXTENSION
C                  16***AWAITING IC 115 (EXTRA WORK AGREEMENT)
C       THE EXPRESSION PERTAINING TO THE REASONS FOR PENALTIES WILL BE IR.
C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *     *   *   *
C       THE FOLLOWING ARE THE DESIGNATIONS FOR THE YEAR EACH CONTRACT
C       HAD THE FINAL ESTIMATE PAID.
C                       2***1972
C                       3***1973
C                       4***1974
C                       5***1975
C                       6***1976
C                       7***1977
C       THE EXPRESSION PERTAINING TO THESE YEARS WILL BE IY.
C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *     *   *   *
C       THIS PROGRAM IS DESIGNED AT PRESENT TO BE SEPARATELY RUN FOR
C       EACH YEAR FROM 1972 THRU 1977
C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *     *   *   *
C       N=TOTAL NUMBER OF CONTRACTS FOR THE YEAR
C       N1=NUMBER OF ROAD CONTRACTS FOR THE YEAR
C       N2=NUMBER OF ROAD CONTRACTS IN WHICH PENALTIES WERE PAID
C       N11=NUMBER OF ROAD CONTRACTS WITH A CITY PROJECT ENGINEER
C       N12=NUMBER OF CITY ROAD CONTRACTS IN WHICH PENALTIES WERE PAID
C       N13=NUMBER OF ROAD CONTRACTS WITH A COUNTY PROJECT ENGINEER
C       N14=NUMBER OF COUNTY ROAD CONTRACTS IN WHICH PENALTIES WERE PAID
C       N15=NUMBER OF ROAD CONTRACTS WITH A STATE PROJECT ENGINEER
C       N16=NUMBER OF STATE ROAD CONTRACTS IN WHICH PENALTIES WERE PAID
C       N17=NUMBER OF ROAD CONTRACTS IN DISTRICT 1
C       N18=NUMBER OF ROAD CONTRACTS IN DISTRICT 1 WITH PENALTIES
C       N19=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 1
C       N20=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 1 WITH PENALTIES
C       N21=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 1
C       N22=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 1 WITH PENALTIES
C       N23=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 1
C       N24=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 1 WITH PENALTIES
C       N25=NUMBER OF ROAD CONTRACTS IN DISTRICT 2
C       N26=NUMBER OF ROAD CONTRACTS IN DISTRICT 2 WITH PENALTIES
C       N27=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 2
C       N28=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 2 WITH PENALTIES
C       N29=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 2
C       N30=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 2 WITH PENALTIES
C       N31=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 2
C       N32=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 2 WITH PENALTIES
C       N33=NUMBER OF ROAD CONTRACTS IN DISTRICT 3
C       N34=NUMBER OF ROAD CONTRACTS IN DISTRICT 3 WITH PENALTIES
C       N35=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 3
C       N36=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 3 WITH PENALTIES
C       N37=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 3
C       N38=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 3 WITH PENALTIES
C       N39=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 3
C       N40=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 3 WITH PENALTIES
C       N41=NUMBER OF ROAD CONTRACTS IN DISTRICT 4
C       N42=NUMBER OF ROAD CONTRACTS IN DISTRICT 4 WITH PENALTIES
C       N43=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 4
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C        N44=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 4 WITH PENALTIES
C        N45=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 4
C        N46=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 4 WITH PENALTIES
C        N47=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 4
C        N48=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 4 WITH PENALTIES
C        N49=NUMBER OF ROAD CONTRACTS IN DISTRICT 5
C        N50=NUMBER OF ROAD CONTRACTS IN DISTRICT 5 WITH PENALTIES
C        N51=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 5
C        N52=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 5 WITH PENALTIES
C        N53=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 5
C        N54=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 5 WITH PENALTIES
C        N55=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 5
C        N56=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 5 WITH PENALTIES
C        N57=NUMBER OF ROAD CONTRACTS IN DISTRICT 6
C        N58=NUMBER OF ROAD CONTRACTS IN DISTRICT 6 WITH PENALTIES
C        N59=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 6
C        N60=NUMBER OF CITY ROAD CONTRACTS IN DISTRICT 6 WITH PENALTIES
C        N61=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 6
C        N62=NUMBER OF COUNTY ROAD CONTRACTS IN DISTRICT 6 WITH PENALTIES
C        N63=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 6
C        N64=NUMBER OF STATE ROAD CONTRACTS IN DISTRICT 6 WITH PENALTIES
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *    *  *  *
C        X=TOTAL PENALTY FOR ROAD CONTRACTS
C        X1=TOTAL PENALTY FOR CITY ROAD CONTRACTS
C        X2=TOTAL PENALTY FOR COUNTY ROAD CONTRACTS
C        X3=TOTAL PENALTY FOR STATE ROAD CONTRACTS
C        X4=TOTAL PENALTY FOR DISTRICT 1 ROAD CONTRACTS
C        X5=TOTAL PENALTY FOR DISTRICT 1 CITY ROAD CONTRACTS
C        X6=TOTAL PENALTY FOR DISTRICT 1 COUNTY ROAD CONTRACTS
C        X7=TOTAL PENALTY FOR DISTRICT 1 STATE ROAD CONTRACTS
C        X8=TOTAL PENALTY FOR DISTRICT 2 ROAD CONTRACTS
C        X9=TOTAL PENALTY FOR DISTRICT 2 CITY ROAD CONTRACTS
C        X10=TOTAL PENALTY FOR DISTRICT 2 COUNTY ROAD CONTRACTS
C        X11=TOTAL PENALTY FOR DISTRICT 2 STATE ROAD CONTRACTS
C        X12=TOTAL PENALTY FOR DISTRICT 3 ROAD CONTRACTS
C        X13=TOTAL PENALTY FOR DISTRICT 3 CITY ROAD CONTRACTS
C        X14=TOTAL PENALTY FOR DISTRICT 3 COUNTY ROAD CONTRACTS
C        X15=TOTAL PENALTY FOR DISTRICT 3 STATE ROAD CONTRACTS
C        X16=TOTAL PENALTY FOR DISTRICT 4 ROAD CONTRACTS
C        X17=TOTAL PENALTY FOR DISTRICT 4 CITY ROAD CONTRACTS
C        X18=TOTAL PENALTY FOR DISTRICT 4 COUNTY ROAD CONTRACTS
C        X19=TOTAL PENALTY FOR DISTRICT 4 STATE ROAD CONTRACTS
C        X20=TOTAL PENALTY FOR DISTRICT 5 ROAD CONTRACTS
C        X21=TOTAL PENALTY FOR DISTRICT 5 CITY ROAD CONTRACTS
C        X22=TOTAL PENALTY FOR DISTRICT 5 COUNTY ROAD CONTRACTS
C        X23=TOTAL PENALTY FOR DISTRICT 5 STATE ROAD CONTRACTS
C        X24=TOTAL PENALTY FOR DISTRICT 6 ROAD CONTRACTS
C        X25=TOTAL PENALTY FOR DISTRICT 6 CITY ROAD CONTRACTS
C        X26=TOTAL PENALTY FOR DISTRICT 6 COUNTY ROAD  CONTRACTS
C        X27=TOTAL PENALTY FOR DISTRICT 6 STATE ROAD CONTRACTS
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *    *  *  *
C   NOTE***   THE DEFINITIONS ABOVE FOR THE N AND X VARIABLES ARE FOR
C             ROAD CONTRACTS.  FOR THE OTHER CONTRACTS, THE SAME
C             DEFINITIONS APPLY EXCEPT THAT FOR BRIDGES, M AND Y ARE
C             USED, FOR ROAD*TRAFFIC, L AND Z ARE USED, FOR
C             ROAD*SURFACING, K AND V ARE USED, AND FOR ROAD*MAINTENANCE
C             J AND U ARE USED.
C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *    *  *  *
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000000t      1.       DATA N,N1,N2,N11,N12,N13,N14,N15,N16/9*0/
002051s      2.       DATA N17,N18,N19,N20,N21,N22,N23,N24,N25,N26,N27,N28,N29/13*0/
032051o      3.       DATA N30,N31,N32,N33,N34,N35,N36,N37,N38,N39,N40,N41,N42/13*0/
002051b      4.       DATA N43,N44,N45,N46,N47,N48,N49,N50,N51,N52,N53,N54,N55/13*0/
002051t      5.       DATA N56,N57,N58,N59,N60,N61,N62,N63,N64/9*0/
002051t      6.       DATA X,X1,X2,X3,X4,X5,X6,X7,X8,X9,X10,X11,X12,X13,X14,X15/16*0.00/
002051s      7.       DATA X16,X17,X18,X19,X20,X21,X22,X23,X24,X25,X26,X27/12*0.00/
002051b      8.       DATA M1,M2,M11,M12,M13,M14,M15,M16/8*0/
002051b      9.       DATA M17,M18,M19,M20,M21,M22,M23,M24,M25,M26,M27,M28,M29/13*0/
002051P     10.       DATA M30,M31,M32,M33,M34,M35,M36,M37,M38,M39,M40,M41,M42/13*0/
002051s     11.       DATA M43,M44,M45,M46,M47,M48,M49,M50,M51,M52,M53,M54,M55/13*0/
002051s     12.       DATA M56,M57,M58,M59,M60,M61,M62,M63,M64/9*0/
002051b     13.       DATA Y,Y1,Y2,Y3,Y4,Y5,Y6,Y7,Y8,Y9,Y10,Y11,Y12,Y13,Y14,Y15/16*0.00/
002051b     14.       DATA Y16,Y17,Y18,Y19,Y20,Y21,Y22,Y23,Y24,Y25,Y26,Y27/12*0.00/
002051b     15.       DATA L1,L2,L11,L12,L13,L14,L15,L16/8*0/
002051b     16.       DATA L17,L18,L19,L20,L21,L22,L23,L24,L25,L26,L27,L28,L29/13*0/
002051s     17.       DATA L30,L31,L32,L33,L34,L35,L36,L37,L38,L39,L40,L41,L42/13*0/
002051s     18.       DATA L43,L44,L45,L46,L47,L48,L49,L50,L51,L52,L53,L54,L55/13*0/
002051c     19.       DATA L56,L57,L58,L59,L60,L61,L62,L53,L64/9*0/
002051s     20.       DATA Z,Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8,Z9,Z10,Z11,Z12,Z13,Z14,Z15/16*0.00/
0C2051b     21.       DATA Z16,Z17,Z18,Z19,Z20,Z21,Z22,Z23,Z24,Z25,Z26,Z27/12*0.00/
002051t     22.       DATA K1,K2,K11,K12,K13,K14,K15,K16/8*0/
002051t     23.       DATA K17,K18,K19,K20,K21,K22,K23,K24,K25,K26,K27,K28,K29/13*0/
002051b     24.       DATA K30,K31,K32,K33,K34,K35,K36,K37,K38,K39,K40,K41,K42/13*0/
002051b     25.       DATA K43,K44,K45,K46,K47,K48,K49,K50,K51,K52,K53,K54,K55/13*0/
002051b     26.       DATA K56,K57,K58,K59,K60,K61,K62,K63,K64/9*0/
002051L     27.       DATA V,V1,V2,V3,V4,V5,V6,V7,V8,V9,V10,V11,V12,V13,V14,V15/16*0.00/
002051b     28.       DATA V16,V17,V18,V19,V20,V21,V22,V23,V24,V25,V26,V27/12*0.00/
002051t     29.       DATA J1,J2,J11,J12,J13,J14,J15,J16/8*0/
002051s     30.       DATA J17,J18,J19,J20,J21,J22,J23,J24,J25,J26,J27,J28,J29/13*0/
002051s     31.       DATA J30,J31,J32,J33,J34,J35,J36,J37,J38,J39,J40,J41,J42/13*0/
002051b     32.       DATA J43,J44,J45,J46,J47,J48,J49,J50,J51,J52,J53,J54,J55/13*0/
002051b     33.       DATA J56,J57,J58,J59,J60,J61,J62,J63,J64/9*0/
002051b     34.       DATA U,U1,U2,U3,U4,U5,U6,U7,U8,U9,U10,U11,J12,J13,U14,U15/16*0.00/
0020519     35.       DATA U16,U17,U18,U19,U20,U21,U22,U23,U24,U25,U26,U27/12*0.00/
002051b     36.       PRINT 703
002722t     37.   703 FORMAT (#1#,20X,#CONTRACTS WITH PENALTIES#,8X,#PENALTY AMOUNT#)
002722L     38.   100 READ 101,C,IT,ICE,IP,PA,IO,IR,TY
002730P     39.   101 FORMAT (A8,X,I2,X,I1,X,I1,X,F8.2,X,I1,X,I2,X,I1)
002730b     40.       IF(IT.EQ.0) GO TO 999
002737s     41.       IF (IP.EQ.1) GO TO 700
0027405     42.   702 N=N+1
002742s     43.       GO TO 704
0027423     44.   700 PRINT 701,C,PA
002751s     45.   701 FORMAT (/,25X,A8,22X,F8.2)
002751t     46.       GO TO 702
002751b     47.   704 IF (IT.EQ.1) GO TO 102
002753b     48.       IF (IT.EQ.2) GO TO 104
002755b     49.       IF (IT.EQ.3) GO TO 105
002756b     50.       IF (IT.EQ.4) GO TO 106
0027608     51.       IF (IT.EQ.5) GO TO 107
0027613     52.       GO TO 100
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C     THE FOLLOWING STATEMENTS STATISTICALLY ANALYZE THE ROAD CONTRACTS
C* * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0027628     53.   102 N1=N1+1
0027643     54.       IF (IP.EQ.1) GO TO 103
002766b     55.       GO TO 112
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0027663     56.    103 N2=N2+1
0027705     57.        X=X+PA
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
            C      THIS SECTION ANALYZES THE ROAD CONTRACTS BY CITY, COUNTY, OR
            C      STATE PROJECT ENGINEER.
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
0027716     58.    112 IF (ICE.EQ.1) GO TO 113
0027736     59.        IF (ICE.EQ.2) GO TO 114
0027755     60.        IF (ICE.EQ.3) GO TO 115
0027766     61.        GO TO 117
0027776     62.    113 N11=N11+1
0030010     63.        IF (IP.EQ.1) GO TO 116
0030038     64.        GO TO 117
0030036     65.    116 N12=N12+1
0030055     66.        X1=X1+PA
0030068     67.        GO TO 117
0030078     68.    114 N13=N13+1
0030116     69.        IF (IP.EQ.1) GO TO 118
0030136     70.        GO TO 117
0030136     71.    118 N14=N14+1
0030153     72.        X2=X2+PA
0030166     73.        GO TO 117
0030176     74.    115 N15=N15+1
0030213     75.        IF (IP.EQ.1) GO TO 119
0030236     76.        GO TO 117
0030233     77.    119 N16=N16+1
0030256     78.        X3=X3+PA
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
            C      THIS SECTION ANALYZES ROAD CONTRACTS BY DISTRICTS.
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
0030266     79.    117 IF(ID.EQ.1) GO TO 120
0030303     80.        IF(ID.EQ.2) GO TO 121
0030326     81.        IF(ID.EQ.3) GO TO 122
0030333     82.        IF(ID.EQ.4) GO TO 123
0030355     83.        IF(ID.EQ.5) GO TO 124
0030366     84.        IF(ID.EQ.6) GO TO 125
003040E     85.        GO TO 126
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
            C                      DISTRICT 1 ANALYSIS
            C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
0030416     86.    120 N17=N17+1
0030426     87.        IF (IP.EQ.1) GO TO 127
0030448     88.        GO TO 128
0030446     89.    127 N18=N18+1
0030466     90.        X4=X4+PA
0030478     91.    128 IF (ICE.EQ.1) GO TO 129
0030518     92.        IF (ICE.EQ.2) GO TO 130
0030538     93.        IF (ICE.EQ.3) GO TO 131
0030546     94.        GO TO 126
0030556     95.    129 N19=N19+1
0030576     96.        IF (IP.EQ.1) GO TO 132
0030618     97.        GO TO 126
0030618     98.    132 N20=N20+1
0030636     99.        X5=X5+PA
0030648    100.        GO TO 126
0030656    101.    130 N21=N21+1
0030676    102.        IF (IP.EQ.1) GO TO 133
0030713    103.        GO TO 126
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0030710    104.    133 N22=N22+1
0030736    105.        X6=X6+PA
0030746    106.        GO TO 126
0030758    107.    131 N23=N23+1
0030776    108.        IF (IP.EQ.1) GO TO 134
0031013    109.        GO TO 126
0031019    110.    134 N24=N24+1
0031036    111.        X7=X7+PA
0031046    112.        GO TO 126
           C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
           C                    DISTRICT 2 ANALYSIS
           C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
0031050    113.    121 N25=N25+1
0031075    114.        IF (IP.EQ.1) GO TO 135
0031111    115.        GO TO 136
0031111    116.    135 N26=N26+1
003113D    117.        X8=X8+PA
0031146    118.    136 IF (ICE.EQ.1) GO TO 137
0031103    119.        IF (ICE.EQ.2) GO TO 138
0031203    120.        IF (ICE.EQ.3) GO TO 139
0031216    121.        GO TO 126
0031223    122.    137 N27=N27+1
0031246    123.        IF (IP.EQ.1) GO TO 140
0031268    124.        GO TO 126
0031266    125.    140 N28=N28+1
0031303    126.        X9=X9+PA
0031316    127.        GO TO 126
0031328    128.    138 N29=N29+1
0031346    129.        IF (IP.EQ.1) GO TO 141
0031366    130.        GO TO 126
0031368    131.    141 N30=N30+1
0031408    132.        X10=X10+PA
0031418    133.        GO TO 126
0031426    134.    139 N31=N31+1
0031448    135.        IF (IP.EQ.1) GO TO 142
0031466    136.        GO TO 126
0031466    137.    142 N32=N32+1
0031508    138.        X11=X11+PA
003151E    139.        GO TO 126
           C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
           C                    DISTRICT 3 ANALYSIS
           C*  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
0031526    140.    122 N33=N33+1
0031546    141.        IF (IP.EQ.1) GO TO 143
0031568    142.        GO TO 144
0031566    143.    143 N34=N34+1
0031606    144.        X12=X12+PA
0031616    145.    144 IF (ICE.EQ.1) GO TO 145
0031636    146.        IF (ICE.EQ.2) GO TO 146
0031656    147.        IF (ICE.EQ.3) GO TO 147
0031666    148.        GO TO 126
0031676    149.    145 N35=N35+1
0031713    150.        IF (IP.EQ.1) GO TO 148
0031733    151.        GO TO 126
0031736    152.    148 N36=N36+1
0031753    153.        X13=X13+PA
0031766    154.        GO TO 126
0031778    155.    146 N37=N37+1
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0032013    156.          IF (IP.EQ.1) GO TO 149
0032036    157.          GO TO 126
0032036    158.      149 N38=N38+1
00320SE    159.          X14=X14+PA
0032066    160.          GO TO 126
0032073    161.      147 N39=N39+1
0032118    162.          IF (IP.EQ.1) GO TO 150
0032133   ~163.          GO TO 126
0032136    164.      150 N40=N40+1
0032158    165.          X15=X15+PA
0032166    166.          GO TO 126
           C* * * * * * * * * * * * * * * * * * * * * * * *
           C                            OISTRICT 4 ANALYSIS
           C* * * * * * * * * * * * * * * * * * * * * * * *
0032178    167.      123 N41=N41+1
0032215    168.          IF (IP.EQ.1) GO TO 151
0032236    169.          GO TO 152
003223B    170.      151 N42=N42+1
0032256    171.          X16=X16+PA
0032260    172.      152 IF (ICE.EQ.1) GO TO 153
0032308    173.          IF (ICE.EQ.2) GO TO 154
003232B    174.          IF (ICE.EQ.3) GO TO 155
00323SE    175.          GO TO 126
0032348    176.      153 N43=N43+1
0032368    177.          IF (IP.EQ.1) GO TO 156
0032403    178.          GO TO 126
0032408    179.      156 N44=N44+1
003242B    180.          X17=X17+PA
0032433    181.          GO TO 126
0032446    182.      154 N45=N45+1
0032468    183.          IF (IP.EQ.1) GO TO 157
0032506    184.          GO TO 126
0032506    185.      157 N46=N46+1
003252E    186.          X18=X18+PA
0032533    187.          GO TO 126
0032546    188.      155 N47=N47+1
0032583    189.          IF (IP.EQ.1) GO TO 158
0032606    190.          GO TO 126
0032600    191.      158 N48=N48+1
003262B    192.          X19=X19+PA
0032636    193.          GO TO 126
           C* * * * * * * * * * * * * * * * * * * * * * * *
           C                            OISTRICT 5 ANALYSTS
           C* * * * * * * * * * * * * * * * * * * * * * * *
0032648    194.      124 N49=N49+1
0032666    195.          IF (IP.EQ.1) GO TO 159
0032706    196.          GO TO 160
00327CB    197.      159 N50=N50+1
0032726    198.          X20=X20+PA
0032738    199.      160 IF (ICE.EQ.1) GO TO 161
0032756    200.          IF (ICE.EQ.2) GO TO 162
003277B    201.          IF (ICE.EQ.3) GO TO 163
0033005    202.          GO TO 126
0033015    203.      161 N51=N51+1
0033035    204.          IF (IP.EQ.1) GO TO 164
003305E    205.          GO TO 126
0033056    206.      164 N52=N52+1
0033078    207.          X21=X21+PA
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0033160    208.        GO TO 126
0033119    209.    162 N53=N53+1
0033133    210.        IF (IP.EQ.1) GO TO 165
0033150    211.        GO TO 126
0033155    212.    165 N54=N54+1
0033170    213.        X22=X22+PA
0033206    214.        GO TO 126
0033210    215.    163 N55=N55+1
0033239    216.        IF (IP.EQ.1) GO TO 166
0033256    217.        GO TO 126
0033253    218.    166 N56=N56+1
0033276    219.        X23=X23+PA
0033300    220.        GO TO 126
           C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
           C                              DISTRICT 6 ANALYSIS
           C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
0033316    221.    125 N57=N57+1
0033330    222.        IF (IP.EQ.1) GO TO 167
0033350    223.        GO TO 168
0033355    224.    167 N58=N58+1
0033376    225.        X24=X24+PA
0033400    226.    168 IF (ICE.EQ.1) GO TO 169
0033420    227.        IF (ICE.EQ.2) GO TO 170
0033446    228.        IF (ICE.EQ.3) GO TO 171
0033455    229.        GO TO 126
0033463    230.    169 N59=N59+1
0033500    231.        IF (IP.EQ.1) GO TO 172
0033520    232.        GO TO 126
0033526    233.    172 N60=N60+1
0033543    234.        X25=X25+PA
0033555    235.        GO TO 126
0033556    236.    170 N61=N61+1
0033600    237.        IF (IP.EQ.1) GO TO 173
0033626    238.        GO TO 126
0033623    239.    173 N62=N62+1
0033646    240.        X26=X26+PA
0033656    241.        GO TO 126
0033663    242.    171 N63=N63+1
0033706    243.        IF (IP.EQ.1) GO TO 174
0033726    244.        GO TO 126
0033720    245.    174 N64=N64+1
0033746    246.        X27=X27+PA
0033753    247.    126 GO TO 100
           C*   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
           C     THE FOLLOWING STATEMENTS STATISTICALLY ANALYZE THE BRIDGE
           C     CONTRACTS
           C *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
0033760    248.    104 M1=M1+1
0034008    249.        IF (IP.EQ.1) GO TO 175
0034023    250.        GO TO 176
0034020    251.    175 M2=M2+1
0034046    252.        Y=Y+PA
           C *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
           C     THIS SECTION ANALYZES THE BRIDGE CONTRACTS BY CITY, COUNTY, OR
           C     STATE PROJECT ENGINEER
           C *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *   *
0034056    253.    176 IF (ICE.EQ.1) GO TO 177
0034078    254.        IF (ICE.EQ.2) GO TO 178
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0034116    255.         IF (ICE.EQ.3) GO TO 179
003412E    256.         GO TO 180
0034130    257.    177  M11=M11+1
0034156    258.         IF (IP.EQ.1) GO TO 181
0034175    259.         GO TO 180
0034176    260.    181  M12=M12+1
0034213    261.         Y1=Y1+PA
003422E    262.         GO TO 180
0034236    263.    178  M13=M13+1
003425B    264.         IF (IP.EQ.1) GO TO 182
0034278    265.         GO TO 180
0034273    266.    182  M14=M14+1
003431E    267.         Y2=Y2+PA
0034325    268.         GO TO 180
003433E    269.    179  M15=M15+1
003435E    270.         IF (IP.EQ.1) GO TO 183
0034373    271.         GO TO 180
0034376    272.    183  M16=M16+1
0034416    273.         Y3=Y3+PA
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C     THIS SECTION ANALYZES BRIDGE CONTRACTS BY DISTRICTS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0034426    274.    180  IF (IO.EQ.1) GO TO 184
0034446    275.         IF (IO.EQ.2) GO TO 185
0034466    276.         IF (IO.EQ.3) GO TO 186
0034476    277.         IF (IO.EQ.4) GO TO 187
0034516    278.         IF (IO.EQ.5) GO TO 188
0034526    279.         IF (IO.EQ.6) GO TO 189
0034546    280.         GO TO 190
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C               DISTRICT 1 ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0034556    281.    184  M17=M17+1
0034566    282.         IF (IP.EQ.1) GO TO 191
0034608    283.         GO TO 192
003460E    284.    191  M18=M18+1
0034626    285.         Y4=Y4+PA
0034633    286.    192  IF(ICE.EQ.1) GO TO 193
0034656    287.         IF (ICE.EQ.2) GO TO 194
0034678    288.         IF (ICE.EQ.3) GO TO 195
0034708    289.         GO TO 190
0034716    290.    193  M19=M19+1
0034733    291.         IF (IP.EQ.1) GO TO 196
0034756    292.         GO TO 190
003475E    293.    196  M20=M20+1
0034773    294.         Y5=Y5+PA
003500E    295.         GO TO 190
0035016    296.    194  M21=M21+1
0035036    297.         IF (IP.EQ.1) GO TO 197
003505E    298.         GO TO 190
0035053    299.    197  M22=M22+1
0035076    300.         Y6=Y6+PA
0035108    301.         GO TO 190
0035116    302.    195  M23=M23+1
0035136    303.         IF (IP.EQ.1) GO TO 198
0035156    304.         GO TO 190
003515E    305.    198  M24=M24+1
0035173    306.         Y7=Y7+PA
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0035206    307.        GO TO 190
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
           C
           C                           DISTRICT 2 ANALYSIS
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
0035216    308.    185 M25=M25+1
0035236    309.        IF (IP.EQ.1) GO TO 199
0035256    310.        GO TO 200
0035256    311.    199 M26=M26+1
0035276    312.        Y8=Y8+PA
0035306    313.    200 IF (ICE.EQ.1) GO TO 201
0035323    314.        IF (ICE.EQ.2) GO TO 202
0035346    315.        IF (ICE.EQ.3) GO TO 203
0035356    316.        GO TO 190
0035363    317.    201 M27=M27+1
0035406    318.        IF (IP.EQ.1) GO TO 204
0035423    319.        GO TO 190
0035426    320.    204 M28=M28+1
0035446    321.        Y9=Y9+PA
0035456    322.        GO TO 190
0035466    323.    202 M29=M29+1
0035506    324.        IF (IP.EQ.1) GO TO 205
0035526    325.        GO TO 190
0035523    326.    205 M30=M30+1
0035546    327.        Y10=Y10+PA
0035556    328.        GO TO 190
0035556    329.    203 M31=M31+1
0035606    330.        IF (IP.EQ.1) GO TO 206
0035626    331.        GO TO 190
0035626    332.    206 M32=M32+1
0035646    333.        Y11=Y11+PA
0035656    334.        GO TO 190
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
           C
           C                           DISTRICT 3 ANALYSIS
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
0035566    335.    186 M33=M33+1
0035706    336.        IF (IP.EQ.1) GO TO 207
0035726    337.        GO TO 208
0035726    338.    207 M34=M34+1
0035746    339.        Y12=Y12+PA
0035756    340.    208 IF (ICE.EQ.1) GO TO 209
0035776    341.        IF (ICE.EQ.2) GO TO 210
0036013    342.        IF (ICE.EQ.3) GO TO 211
0036022    343.        GO TO 190
0036036    344.    209 M35=M35+1
0036053    345.        IF (IP.EQ.1) GO TO 212
0036076    346.        GO TO 190
0036076    347.    212 M36=M36+1
0036116    348.        Y13=Y13+PA
0036126    349.        GO TO 190
0036133    350.    210 M37=M37+1
0036156    351.        IF (IP.EQ.1) GO TO 213
0036176    352.        GO TO 190
0036176    353.    213 M38=M38+1
0036216    354.        Y14=Y14+PA
0036226    355.        GO TO 190
0036236    356.    211 M39=M39+1
0036256    357.        IF (IP.EQ.1) GO TO 214
0036276    358.        GO TO 190
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0036273     359.    214 M40=M40+1
0036310     360.        Y15=Y15+PA
003632E     361.        GO TO 190
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            C                       DISTRICT 4 ANALYSIS
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0036335     362.    187 M41=M41+1
0036353     363.        IF (IP.EQ.1) GO TO 215
0036370     364.        GO TO 216
0036375     365.    215 M42=M42+1
003641E     366.        Y16=Y16+PA
003642E     367.    216 IF (ICE.EQ.1) GO TO 217
003644E     368.        IF (ICE.EQ.2) GO TO 218
0036466     369.        IF (ICE.EQ.3) GO TO 219
003647E     370.        GO TO 190
0036503     371.    217 M43=M43+1
0036523     372.        IF (IP.EQ.1) GO TO 220
0036546     373.        GO TO 190
003654C     374.    220 M44=M44+1
003656E     375.        Y17=Y17+PA
0036576     376.        GO TO 190
003660E     377.    218 M45=M45+1
0036620     378.        IF (IP.EQ.1) GO TO 221
0036643     379.        GO TO 190
0036645     380.    221 M46=M46+1
003666E     381.        Y18=Y18+PA
003667E     382.        GO TO 190
003670C     383.    219 M47=M47+1
0036725     384.        IF (IP.EQ.1) GO TO 222
0036745     385.        GO TO 190
0036743     386.    222 M48=M48+1
003676C     387.        Y19=Y19+PA
0036773     388.        GO TO 190
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            C                       DISTRICT 5 ANALYSIS
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
003700C     389.    188 M49=M49+1
003702C     390.        IF (IP.EQ.1) GO TO 223
0037043     391.        GO TO 224
0037049     392.    223 M50=M50+1
003706E     393.        Y20=Y20+PA
0037073     394.    224 IF (ICE.EQ.1) GO TO 225
0037110     395.        IF (ICE.EQ.2) GO TO 226
003713C     396.        IF (ICE.EQ.3) GO TO 227
003714C     397.        GO TO 190
003715E     398.    225 M51=M51+1
003717C     399.        IF (IP.EQ.1) GO TO 228
0037211     400.        GO TO 190
003721E     401.    228 M52=M52+1
0037233     402.        Y21=Y21+PA
003724C     403.        GO TO 190
003726C     404.    226 M53=M53+1
003727C     405.        IF (IP.EQ.1) GO TO 229
003731C     406.        GO TO 190
003731E     407.    229 M54=M54+1
003733C     408.        Y22=Y22+PA
0037344     409.        GO TO 190
003735E     410.    227 M55=M55+1
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0037376    411.        IF (IP.EQ.1) GO TO 230
003741H    412.        GO TO 190
003741B    413.    230 M56=M56+1
0037435    414.        Y23=Y23+PA
0037448    415.        GO TO 190
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                  DISTRICT   ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0037452    416.    189 M57=M57+1
0037476    417.        IF (IP.EQ.1) GO TO 231
003751B    418.        GO TO 232
003751E    419.    231 M58=M58+1
0037535    420.        Y24=Y24+PA
0037548    421.    232 IF (ICE.EQ.1) GO TO 233
0037565    422.        IF (ICE.EQ.2) GO TO 234
0037655    423.        IF (ICE.EQ.3) GO TO 235
0037616    424.        GO TO 190
0037626    425.    233 M59=M59+1
0037643    426.        IF (IP.EQ.1) GO TO 236
0037666    427.        GO TO 190
0037665    428.    236 M60=M60+1
0037736    429.        Y25=Y25+PA
003771E    430.        GO TO 190
0037726    431.    234 M61=M61+1
0037740    432.        IF (IP.EQ.1) GO TO 237
0037766    433.        GO TO 190
0037776    434.    237 M62=M62+1
0040006    435.        Y26=Y26+PA
0040013    436.        GO TO 190
0040026    437.    235 M63=M63+1
0040043    438.        IF (IP.EQ.1) GO TO 238
0040066    439.        GO TO 190
0040065    440.    238 M64=M64+1
004010L    441.        Y27=Y27+PA
0040116    442.    190 GO TO 100
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C     THE FOLLOWING STATEMENTS STATISTICALLY ANALYZE THE ROAD*TRAFFIC
           C     CONTRACTS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0040126    443.    105 L1=L1+1
004014E    444.        IF (IP.EQ.1) GO TO 239
0040106    445.        GO TO 240
0040163    446.    239 L2=L2+1
004020B    447.        Z=Z+PA
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C     THIS SECTION ANALYZES THE ROAD*TRAFFIC CONTRACTS BY CITY,
           C     COUNTY, OR STATE PROJECT ENGINEER
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
004021B    448.    240 IF (ICE.EQ.1) GO TO 241
0040236    449.        IF (ICE.EQ.2) GO TO 242
0040256    450.        IF (ICE.EQ.3) GO TO 243
0040266    451.        GO TO 244
0040276    452.    241 L11=L11+1
0040316    453.        IF (IP.EQ.I) GO TO 245
004033b    454.        GO TO 244
004033B    455.    245 L12=L12+1
0040355    456.        Z1=Z1+PA
0040363    457.        GO TO 244
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0040376    458.    242 L13=L13+1/
0040416    459.        IF (IP.EQ.1) GO TO 246
0040436    460.        GO TO 244
0040436    461.    246 L14=L14+1
004045E    462.        Z2=Z2+PA
0040466    463.        GO TO 244
0040476    464.    243 L15=L15+1
0040513    465.        IF (IP.EQ.1) GO TO 247
0040536    466.        GO TO 244
0040533    467.    247 L16=L16+1
0040556    468.        Z3=Z3+PA
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C        THIS SECTION ANALYZES ROAD+TRAFFIC CONTRACTS BY DISTRICT
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0040566    469.    244 IF (IO.EQ.1) GO TO 248
0040663    470.        IF (IO.EQ.2) GO TO 249
0040620    471.        IF (IO.EQ.3) GO TO 250
0040636    472.        IF (IO.EQ.4) GO TO 251
0040656    473.        IF (IO.EQ.5) GO TO 252
0040660    474.        IF (IO.EQ.6) GO TO 253
0040706    475.        GO TO 254
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                    DISTRICT 1 ANALYSIS
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0040716    476.    248 L17=L17+1
0040723    477.        IF (IP.EQ.1) GO TO 255
0040743    478.        GO TO 256
0040746    479.    255 L18=L18+1
0040766    480.        Z4=Z4+PA
0040773    481.    256 IF (ICE.EQ.1) GO TO 257
0041013    482.        IF (ICE.EQ.2) GO TO 258
0041036    483.        IF (ICE.EQ.3) GO TO 259
0041046    484.        GO TO 254
0041053    485.    257 L19=L19+1
0041070    486.        IF (IP.EQ.1) GO TO 260
0041110    487.        GO TO 254
0041116    488.    260 L20=L20+1
0041133    489.        Z5=Z5+PA
0041146    490.        GO TO 254
0041156    491.    258 L21=L21+1
0041176    492.        IF (IP.EQ.1) GO TO 261
0041210    493.        GO TO 254
0041216    494.    261 L22=L22+1
0041236    495.        Z6=Z6+PA
0041246    496.        GO TO 254
0041256    497.    259 L23=L23+1
0041276    498.        IF (IP.EQ.1) GO TO 262
0041310    499.        GO TO 254
0041313    500.
0041316    501.    262 L24=L24+1
0041336    501.        Z7=Z7+PA
0041340    502.        GO TO 254
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                    DISTRICT 2 ANALYSIS
           C    * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0041356    503.    249 L25=L25+1
0041378    504.        IF (IP.EQ.1) GO TO 263
0041416    505.        GO TO 264
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0041414      506.      263 L26=L26+1
0041438      507.          Z8=Z8+PA
0041446      508.      264 IF (ICE.EQ.1) GO TO 265
0041460      509.          IF (ICE.EQ.2) GO TO 266
0041505      510.          IF (ICE.EQ.3) GO TO 267
0041516      511.          GO TO 254
0041526      512.      265 L27=L27+1
0041546      513.          IF (IP.EQ.1) GO TO 268
0041566      514.          GO TO 254
0041566      515.      268 L28=L28+1
0041603      516.          Z9=Z9+PA
0041618      517.          GO TO 254
0041623      518.      266 L29=L29+1
0041646      519.          IF (IP.EQ.1) GO TO 269
0041665      520.          GO TO 254
0041668      521.      269 L30=L30+1
0041705      522.          Z10=Z10+PA
0041716      523.          GO TO 254
0041723      524.      267 L31=L31+1
0041748      525.          IF (IP.EQ.1) GO TO 270
0041766      526.          GO TO 254
0041763      527.      270 L32=L32+1
0042006      528.          Z11=Z11+PA
0042016      529.          GO TO 254
C      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                           DISTRICT 3 ANALYSIS
C      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0042026      530.      250 L33=L33+1
0042046      531.          IF (IP.EQ.1) GO TO 271
0042063      532.          GO TO 272
0042066      533.      271 L34=L34+1
0042106      534.          Z12=Z12+PA
0042116      535.      272 IF (ICE.EQ.1) GO TO 273
0042136      536.          IF (ICE.EQ.2) GO TO 274
0042156      537.          IF (ICE.EQ.3) GO TO 275
0042166      538.          GO TO 254
0042176      539.      273 L35=L35+1
0042216      540.          IF (IP.EQ.1) GO TO 276
0042236      541.          GO TO 254
0042236      542.      276 L36=L36+1
0042253      543.          Z13=Z13+PA
0042266      544.          GO TO 254
0042275      545.      274 L37=L37+1
0042316      546.          IF (IP.EQ.1) GO TO 277
0042336      547.          GO TO 254
0042336      548.      277 L38=L38+1
0042356      549.          Z14=Z14+PA
0042363      550.          GO TO 254
0042376      551.      275 L39=L39+1
0042413      552.          IF (IP.EQ.1) GO TO 278
0042435      553.          GO TO 254
0042436      554.      278 L40=L40+1
0042456      555.          Z15=Z15+PA
0042466      556.          GO TO 254
C      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                           DISTRICT 4 ANALYSIS
C      * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0042478      557.      251 L41=L41+1
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0042516    558.        IF (IP.EQ.1) GO TO 279
0042536    559.        GO TO 280
004253J    560.    279 L42=L42+1
0042556    561.        Z16=Z16+PA
0042566    562.    280 IF (ICE.EQ.1) GO TO 281
0042605    563.        IF (ICE.EQ.2) GO TO 282
0042626    564.        IF (ICE.EQ.3) GO TO 283
0042636    565.        GO TO 254
0042646    566.    281 L43=L43+1
0042655    567.        IF (IP.EQ.1) GO TO 284
0042702    568.        GO TO 254
0042706    569.    284 L44=L44+1
004272J    570.        Z17=Z17+PA
0042736    571.        GO TO 254
0042745    572.    282 L45=L45+1
0042762    573.        IF (IP.EQ.1) GO TO 285
0043003    574.        GO TO 254
0043006    575.    285 L46=L46+1
0043025    576.        Z18=Z18+PA
0043033    577.        GO TO 254
0043046    578.    283 L47=L47+1
0043063    579.        IF (IP.EQ.1) GO TO 286
0043106    580.        GO TO 254
004310J    581.    286 L48=L48+1
0043126    582.        Z19=Z19+PA
0043138    583.        GO TO 254
              C    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              C                        DISTRICT 5 ANALYSIS
              C    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
0043146    584.    252 L49=L49+1
004316J    585.        IF (IP.EQ.1) GO TO 287
0043202    586.        GO TO 288
0043206    587.    287 L50=L50+1
0043226    588.        Z20=Z20+PA
0043236    589.    288 IF (ICE.EQ.1) GO TO 289
0043255    590.        IF (ICE.EQ.2) GO TO 290
0043276    591.        IF (ICE.EQ.3) GO TO 291
0043303    592.        GO TO 254
0043316    593.    289 L51=L51+1
0043336    594.        IF (IP.EQ.1) GO TO 292
0043356    595.        GO TO 254
0043356    596.    292 L52=L52+1
0043370    597.        Z21=Z21+PA
0043406    598.        GO TO 254
0043413    599.    290 L53=L53+1
004343E    600.        IF (IP.EQ.1) GO TO 293
0043456    601.        GO TO 254
0043458    602.    293 L54=L54+1
0043478    603.        Z22=Z22+PA
0043503    604.        GO TO 254
0043516    605.    291 L55=L55+1
0043536    606.        IF (IP.EQ.1) GO TO 294
0043553    607.        GO TO 254
0043556    608.    294 L56=L56+1
0043576    609.        Z23=Z23+PA
0043608    610.        GO TO 254
              C    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              C                        DISTRICT 6 ANALYSIS
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                    C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0043618     611.      253 L57=L57+1
0043635     612.          IF (IP.EQ.1) GO TO 295
0043656     613.          GO TO 296
0043653     614.      295 L58=L58+1
0043676     615.          Z24=Z24+PA
0043703     616.      296 IF (ICE.EQ.1) GO TO 297
0043726     617.          IF (ICE.EQ.2) GO TO 298
0043746     618.          IF (ICE.EQ.3) GO TO 299
0043756     619.          GO TO 254
0043766     620.      297 L59=L59+1
0044003     621.          IF (IP.EQ.1) GO TO 300
0044026     622.          GO TO 254
0044023     623.      300 L60=L60+1
0044046     624.          Z25=Z25+PA
0044053     625.          GO TO 254
0044066     626.      298 L61=L61+1
0044106     627.          IF (IP.EQ.1) GO TO 301
0044126     628.          GO TO 254
0044126     629.      301 L62=L62+1
0044146     630.          Z26=Z26+PA
0044156     631.          GO TO 254
0044163     632.      299 L63=L63+1
0044203     633.          IF (IP.EQ.1) GO TO 302
0044226     634.          GO TO 254
0044223     635.      302 L64=L64+1
0044246     636.          Z27=Z27+PA
0044256     637.      254 GO TO 100
                    C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
                    C     THE FOLLOWING STATEMENTS STATISTICALLY ANALYZE THE ROAD-SURFACING
                    C     CONTRACTS
                    C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0044266     638.      106 K1=K1+1
0044300     639.          IF (IP.EQ.1) GO TO 303
0044326     640.          GO TO 304
0044326     641.      303 K2=K2+1
0044346     642.          V=V+PA
                    C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
                    C     THIS SECTION ANALYZES THE ROAD-SURFACING CONTRACTS BY CITY,
                    C     COUNTY, OR STATE PROJECT ENGINEER
                    C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0044356     643.      304 IF (ICE.EQ.1) GO TO 305
0044376     644.          IF (ICE.EQ.2) GO TO 306
0044413     645.          IF (ICE.EQ.3) GO TO 307
0044417     646.
0044426     647.          GO TO 308
0044436     647.      305 K11=K11+1
0044453     648.          IF (IP.EQ.1) GO TO 309
0044476     649.          GO TO 308
0044476     650.      309 K12=K12+1
0044516     651.          V1=V1+PA
0044526     652.          GO TO 308
0044533     653.      306 K13=K13+1
0044556     654.          IF (IP.EQ.1) GO TO 310
0044576     655.          GO TO 308
0044576     656.      310 K14=K14+1
0044613     657.          V2=V2+PA
0044626     658.          GO TO 308
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004463E    659.    307 K15=K15+1
0044652    660.        IF (IP.EQ.1) GO TO 311
0044673    661.        GO TO 308
004467o    662.    311 K16=K16+1
004471c    663.        V3=V3+PA
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C       THIS SECTION ANALYZES ROAD*SURFACING CONTRACTS BY DISTRICTS
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
004472b    664.    308 IF (ID.EQ.1) GO TO 312
004474C    665.        IF (ID.EQ.2) GO TO 313
0044768    666.        IF (ID.EU.3) GO TO 314
0044775    667.        IF (ID.EQ.4) GO TO 315
004501C    668.        IF (ID.EQ.5) GO TO 316
0045023    669.        IF (ID.EQ.6) GO TO 317
0045046    670.        GO TO 318
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                          DISTRICT 1 ANALYSIS
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0045056    671.    312 K17=K17+1
004506C    672.        IF (IP.EQ.1) GO TO 319
004510C    673.        GO TO 320
0045106    674.    319 K18=K18+1
004512C    675.        V4=V4+PA
0045136    676.    320 IF (ICE.EQ.1) GO TO 321
004515C    677.        IF (ICE.EQ.2) GO TO 322
0045173    678.        IF (ICE.EQ.3) GO TO 323
004520C    679.        GO TO 318
0045216    680.    321 K19=K19+1
0045233    681.        IF (IP.EQ.1) GO TO 324
004525C    682.        GO TO 318
004525C    683.    324 K20=K20+1
004527C    684.        V5=V5+PA
004530J    685.        GO TO 318
0045316    686.    322 K21=K21+1
0045338    687.        IF (IP.EQ.1) GO TO 325
004535C    688.        GO TO 318
0045353    689.    325 K22=K22+1
0045373    690.        V6=V6+PA
004540C    691.        GO TO 318
004541C    692.    323 K23=K23+1
004543C    693.        IF (IP.EQ.1) GO TO 326
0045456    694.        GO TO 318
004545b    695.    326 K24=K24+1
004547c    696.        V7=V7+PA
0045508    697.        GO TO 318
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                          DISTRICT 2 ANALYSIS
C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
004551B    698.    313 K25=K25+1
0045533    699.        IF (IP.EQ.1) GO TO 327
004555C    700.        GO TO 328
0045553    701.    327 K26=K26+1
004557C    702.        V8=V8+PA
0045606    703.    328 IF (IICE.EQ.1) GO.TO 329
004562C    704.        IF (IICE.EQ.2) GO TO 330
004564C    705.        IF (IICE.EQ.3) GO TO 331
0045656    706.        GO TO 318
0045663    707.    329 K27=K27+1
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0045706    708.         IF (IP.EQ.1) GO TO 332
0045725    709.         GO TO 318
0045725    710.    332  K28=K28+1
0045746    711.         V9=V9+PA
0045756    712.         GO TO 318
0045763    713.    330  K29=K29+1
0046000    714.         IF (IP.EQ.1) GO TO 333
0046023    715.         GO TO 318
0046026    716.    333  K30=K30+1
0046046    717.         V10=V10+PA
0046056    718.         GO TO 318
0046056    719.    331  K31=K31+1
0046106    720.         IF (IP.EQ.1) GO TO 334
0046126    721.         GO TO 318
0046125    722.    334  K32=K32+1
0046146    723.         V11=V11+PA
0046156    724.         GO TO 318
           C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                        DISTRICT 3 ANALYSIS
           C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0046166    725.    314  K33=K33+1
0046206    726.         IF (IP.EQ.1) GO TO 335
0046226    727.         GO TO 336
0046226    728.    335  K34=K34+1
0046246    729.         V12=V12+PA
0046256    730.    336  IF (ICE.EQ.1) GO TO 337
0046276    731.         IF (ICE.EQ.2) GO TO 338
0046315    732.         IF (ICE.EQ.3) GO TO 339
0046325    733.         GO TO 318
0046335    734.    337  K35=K35+1
0046356    735.         IF (IP.EQ.1) GO TO 340
0046376    736.         GO TO 318
0046376    737.    340  K36=K36+1
0046415    738.         V13=V13+PA
0046426    739.         GO TO 318
0046436    740.    338  K37=K37+1
0046456    741.         IF (IP.EQ.1) GO TO 341
0046476    742.         GO TO 318
0046475    743.    341  K38=K38+1
0046516    744.         V14=V14+PA
0046526    745.         GO TO 318
0046533    746.    339  K39=K39+1
0046556    747.         IF (IP.EQ.1) GO TO 342
0046576    748.         GO TO 318
0046576    749.    342  K40=K40+1
0046615    750.         V15=V15+PA
0046626    751.         GO TO 318
           C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                        DISTRICT 4 ANALYSIS
           C  * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0046636    752.    315  K41=K41+1
0046656    753.         IF (IP.EQ.1) GO TO 343
0046676    754.         GO TO 344
0046675    755.    343  K42=K42+1
0046716    756.         V16=V16+PA
0046726    757.    344  IF (ICE.EQ.1) GO TO 345
0046746    758.         IF (ICE.EQ.2) GO TO 346
0046763    759.         IF (ICE.EQ.3) GO TO 347
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0046778    760.        GO TO 318
0047006    761.    345 K43=K43+1
0047028    762.        IF (IP.EQ.1) GO TO 348
0047046    763.        GO TO 318
0047046    764.    348 K44=K44+1
0047068    765.        V17=V17+PA
0047078    766.        GO TO 318
0047108    767.    346 K45=K45+1
0047126    768.        IF (IP.EQ.1) GO TO 349
0047143    769.        GO TO 318
0047146    770.    349 K46=K46+1
0047166    771.        V18=V18+PA
0047178    772.        GO TO 318
0047208    773.    347 K47=K47+1
0047228    774.        IF (IP.EQ.1) GO TO 350
0047248    775.        GO TO 318
0047248    776.    350 K48=K48+1
0047266    777.        V19=V19+PA
0047278    778.        GO TO 318
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                        DISTRICT 5 ANALYSIS
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0047306    779.    316 K49=K49+1
0047326    780.        IF (IP.EQ.1) GO TO 351
0047343    781.        GO TO 352
0047346    782.    351 K50=K50+1
0047366    783.        V20=V20+PA
0047378    784.    352 IF (ICE.EQ.1) GO TO 353
0047416    785.        IF (ICE.EQ.2) GO TO 354
0047438    786.        IF (ICE.EQ.3) GO TO 355
0047446    787.        GO TO 318
0047456    788.    353 K51=K51+1
0047478    789.        IF (IP.EQ.1) GO TO 356
0047518    790.        GO TO 318
0047516    791.    356 K52=K52+1
0047536    792.        V21=V21+PA
0047548    793.        GO TO 318
0047558    794.    354 K53=K53+1
0047576    795.        IF (IP.EQ.1) GO TO 357
0047616    796.        GO TO 318
0047613    797.    357 K54=K54+1
0047636    798.        V22=V22+PA
0047648    799.        GO TO 318
0047653    800.    355 K55=K55+1
0047676    801.        IF (IP.EQ.1) GO TO 358
0047716    802.        GO TO 318
0047716    803.    358 K56=K56+1
0047738    804.        V23=V23+PA
0047746    805.        GO TO 318
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
C                        DISTRICT 6 ANALYSIS
C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0047756    806.    317 K57=K57+1
0047778    807.        IF (IP.EQ.1) GO TO 359
0050016    808.        GO TO 360
0050016    809.    359 K58=K58+1
0050036    810.        V24=V24+PA
0050046    811.    360 IF (ICE.EQ.1) GO TO 361
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0050006L   812.        IF (ICE.EQ.2) GO TO 362
0050010L   813.        IF (ICE.EQ.3) GO TO 363
0050011E   814.        GO TO 318
0050012E   815.   361  K59=K59+1
0050014E   816.        IF (IP.EQ.1) GO TO 364
0050016B   817.        GO TO 318
0050016B   818.   364  K60=K60+1
0050020B   819.        V25=V25+PA
0050021B   820.        GO TO 318
0050022B   821.   362  K61=K61+1
0050024E   822.        IF (IP.EQ.1) GO TO 365
0050026B   823.        GO TO 318
0050026E   824.   365  K62=K62+1
0050030B   825.        V26=V26+PA
0050031B   826.        GO TO 318
0050032E   827.   363  K63=K63+1
0050034B   828.        IF (IP.EQ.1) GO TO 366
0050036B   829.        GO TO 318
0050036B   830.   366  K64=K64+1
0050040S   831.        V27=V27+PA
0050041B   832.   318  GO TO 100
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
           C
           C     THE FOLLOWING STATEMENTS STATISTICALLY ANALYZE THE
           C     ROAD*MAINTENANCE CONTRACTS
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
0050042B   833.   107  J1=J1+1
0050044E   834.        IF (IP.EQ.1) GO TO 367
0050046E   835.        GO TO 368
0050046B   836.   367  J2=J2+1
0050050B   837.        U=U+PA
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
           C
           C     THIS SECTION ANALYZES THE ROAD*MAINTENANCE CONTRACTS BY CITY,
           C     COUNTY, OR STATE PROJECT ENGINEER
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
0050051B   838.   368  IF (ICE.EQ.1) GO TO 369
0050053B   839.        IF (ICE.EQ.2) GO TO 370
0050055S   840.        IF (ICE.EQ.3) GO TO 371
0050056B   841.        GO TO 372
0050057B   842.   369  J11=J11+1
0050061B   843.        IF (IP.EQ.1) GO TO 373
0050063E   844.        GO TO 372
0050063B   845.   373  J12=J12+1
0050065B   846.        U1=U1+PA
0050066B   847.        GO TO 372
0050067S   848.   370  J13=J13+1
0050071S   849.        IF (IP.EQ.1) GO TO 374
0050073E   850.        GO TO 372
0050073S   851.   374  J14=J14+1
0050075E   852.        U2=U2+PA
0050076S   853.        GO TO 372
0050077B   854.   371  J15=J15+1
0051001B   855.        IF (IP.EQ.1) GO TO 375
0051003B   856.        GO TO 372
0051003E   857.   375  J16=J16+1
0051005B   858.        J3=U3+PA
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
           C     THIS SECTION ANALYZES ROAD*MAINTENANCE CONTRACTS BY DISTRICTS
           C  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
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0051066     859.     372 IF (IU.EQ.1) GO TO 376
0051106     860.         IF (IU.EQ.2) GO TO 377
0051126     861.         IF (IU.EQ.3) GO TO 378
0051138     862.         IF (IU.EQ.4) GO TO 379
0051153     863.         IF (IU.EQ.5) GO TO 380
005116B     864.         IF (IU.EQ.6) GO TO 381
0051203     865.         GO TO 382
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            C                      DISTRICT 1 ANALYSIS
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0051216     866.     376 J17=J17+1
005122B     867.         IF (IP.EQ.1) GO TO 383
0051248     868.         GO TO 384
0051248     869.     383 J18=J18+1
0051266     870.         U4=U4+PA
005127E     871.     384 IF (ICE.EQ.1) GO TO 385
0051316     872.         IF (ICE.EQ.2) GO TO 386
005133B     873.         IF (ICE.EQ.3) GO TO 387
0051346     874.         GO TO 382
0051353     875.     385 J19=J19+1
0051370     876.         IF (IP.EQ.1) GO TO 388
0051416     877.         GO TO 382
0051416     878.     388 J20=J20+1
0051438     879.         U5=U5+PA
0051448     880.         GO TO 382
005145E     881.     386 J21=J21+1
005147E     882.         IF (IP.EQ.1) GO TO 389
005151E     883.         GO TO 382
0051513     884.     389 J22=J22+1
005153E     885.         U6=U6+PA
0051548     886.         GO TO 382
005155B     887.     387 J23=J23+1
0051575     888.         IF (IP.EQ.1) GO TO 390
005161B     889.         GO TO 382
0051613     890.     390 J24=J24+1
005163E     891.         U7=U7+PA
005164D     892.         GO TO 382
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
            C                      DISTRICT 2 ANALYSIS
            C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
005165D     893.     377 J25=J25+1
005167D     894.         IF (IP.EQ.1) GO TO 391
005171D     895.         GO TO 392
005171D     896.     391 J26=J26+1
0051735     897.         U8=U8+PA
005174E     898.     392 IF (ICE.EQ.1) GO TO 393
0051766     899.         IF (ICE.EQ.2) GO TO 394
0052008     900.         IF (ICE.EQ.3) GO TO 395
005201E     901.         GO TO 382
0052026     902.     393 J27=J27+1
0052048     903.         IF (IP.EQ.1) GO TO 396
0052068     904.         GO TO 382
0052063     905.     396 J28=J28+1
0052108     906.         U9=U9+PA
005211B     907.         GO TO 382
0052126     908.     394 J29=J29+1
0052143     909.         IF (IP.EQ.1) GO TO 397
005216B     910.         GO TO 382
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0052160    911.    397 J30=J30+1
0052208    912.        U10=U10+PA
0052216    913.        GO TO 382
0052223    914.    395 J31=J31+1
0052246    915.        IF (IP.EQ.1) GO TO 398
0052268    916.        GO TO 382
0052268    917.    398 J32=J32+1
0052306    918.        U11=U11+PA
0052316    919.        GO TO 382
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                        DISTRICT 3 ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0052326    920.    378 J33=J33+1
0052346    921.        IF (IP.EQ.1) GO TO 399
0052363    922.        GO TO 400
0052366    923.    399 J34=J34+1
0052406    924.        U12=U12+PA
0052416    925.    400 IF (ICE.EQ.1) GO TO 401
0052438    926.        IF (ICE.EQ.2) GO TO 402
0052453    927.        IF (ICE.EQ.3) GO TO 403
0052466    928.        GO TO 382
0052476    929.    401 J35=J35+1
0052516    930.        IF (IP.EQ.1) GO TO 404
0052533    931.        GO TO 382
0052536    932.    404 J36=J36+1
0052556    933.        U13=U13+PA
0052566    934.        GO TO 382
0052578    935.    402 J37=J37+1
0052618    936.        IF (IP.EQ.1) GO TO 405
0052633    937.        GO TO 382
0052636    938.    405 J38=J38+1
0052656    939.        U14=U14+PA
0052666    940.        GO TO 382
0052676    941.    403 J39=J39+1
0052716    942.        IF (IP.EQ.1) GO TO 406
0052736    943.        GO TO 382
0052736    944.    406 J40=J40+1
0052756    945.        U15=U15+PA
0052766    946.        GO TO 382
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                        DISTRICT 4 ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0052776    947.    379 J41=J41+1
0053016    948.        IF (IP.EQ.1) GO TO 407
0053036    949.        GO TO 408
0053036    950.    407 J42=J42+1
0053056    951.        U16=U16+PA
0053066    952.    408 IF (ICE.EQ.1) GO TO 409
0053103    953.        IF (ICE.EQ.2) GO TO 410
0053126    954.        IF (ICE.EQ.3) GO TO 411
0053136    955.        GO TO 382
0053146    956.    409 J43=J43+1
0053166    957.        IF (IP.EQ.1) GO TO 412
0053206    958.        GO TO 382
0053206    959.    412 J44=J44+1
0053226    960.        U17=U17+PA
0053236    961.        GO TO 382
0053246    962.    410 J45=J45+1
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0053266    963.        IF (IP.EQ.1) GO TO 413
0053306    964.        GO TO 382
0053303    965.    413 J46=J46+1
0053323    966.        U18=U18+PA
0053336    967.        GO TO 382
0053343    968.    411 J47=J47+1
0053366    969.        IF (IP.EQ.1) GO TO 414
0053406    970.        GO TO 382
0053406    971.    414 J48=J48+1
0053426    972.        U19=U19+PA
0053436    973.        GO TO 382
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                       DISTRICT   ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0053446    974.    380 J49=J49+1
0053466    975.        IF (IP.EQ.1) GO TO 415
0053503    976.        GO TO 416
0053503    977.    415 J50=J50+1
0053526    978.        U20=U20+PA
0053553    979.    416 IF (ICE.EQ.1) GO TO 417
0053556    980.        IF (ICE.EQ.2) GO TO 418
0053573    981.        IF (ICE.EQ.3) GO TO 419
0053606    982.        GO TO 382
0053616    983.    417 J51=J51+1
005363L    984.        IF (IP.EQ.1) GO TO 420
0053656    985.        GO TO 382
0053656    986.    420 J52=J52+1
0053678    987.        U21=U21+PA
0053706    988.        GO TO 382
0053713    989.    418 J53=J53+1
005373E    990.        IF (IP.EQ.1) GO TO 421
005375D    991.        GO TO 382
0053752    992.    421 J54=J54+1
0053776    993.        U22=U22+PA
0054006    994.        GO TO 382
0054016    995.    419 J55=J55+1
0054036    996.        IF (IP.EQ.1) GO TO 422
0054056    997.        GO TO 382
0054056    998.    422 J56=J56+1
005407E    999.        U23=U23+PA
0054106   1000.        GO TO 382
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
           C                       DISTRICT 6 ANALYSIS
           C * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
005411E   1001.    381 J57=J57+1
0054136   1002.        IF (IP.EQ.1) GO TO 423
0054156   1003.        GO TO 424
005415E   1004.    423 J58=J58+1
005417E   1005.        U24=U24+PA
0054203   1006.    424 IF (ICE.EQ.1) GO TO 425
0054226   1007.        IF (ICE.EQ.2) GO TO 426
005424E   1008.        IF (ICE.EQ.3) GO TO 427
0054253   1009.        GO TO 382
0054266   1010.    425 J59=J59+1
0054306   1011.        IF (IP.EQ.1) GO TO 428
005432E   1012.        GO TO 382
005432E   1013.    428 J60=J60+1
0054346   1014.        U25=U25+PA
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0054356    1015.          GO TO 382
0054366    1016.     426  J61=J61+1
005440E    1017.          IF (IP.EQ.1) GO TO 429
0054425    1018.          GO TO 382
0054428    1019.     429  J62=J62+1
0054446    1020.          U26=U26+PA
0054456    1021.          GO TO 382
0054466    1022.     427  J63=J63+1
00545506   1023.          IF (IP.EQ.1) GO TO 430
0054528    1024.          GO TO 382
0054526    1025.     430  J64=J64+1
0054546    1026.          U27=U27+PA
0054555    1027.     382  GO TO 100
0054566    1028.     999  NR=(N2*100)/N1
0054626    1029.          NR1=(N12*100)/N11
0054666    1030.          NR2=(N14*100)/N13
0054716    1031.          NR3=(N16*100)/N15
0054756    1032.          NR4=(N18*100)/N17
0055006    1033.          NR5=(N20*100)/N19
0055046    1034.          NR6=(N22*100)/N21
0055076    1035.          NR7=(N24*100)/N23
0055136    1036.          NR8=(N26*100)/N25
0055166    1037.          NR9=(N28*100)/N27
0055223    1038.          NR10=(N30*100)/N29
0055256    1039.          NR11=(N32*100)/N31
0055316    1040.          NR12=(N34*100)/N33
0055343    1041.          NR13=(N36*100)/N35
0055406    1042.          NR14=(N38*100)/N37
0055436    1043.          NR15=(N40*100)/N39
0055476    1044.          NR16=(N42*100)/N41
0055526    1045.          NR17=(N44*100)/N43
0055566    1046.          NR18=(N46*100)/N45
0055616    1047.          NR19=(N48*100)/N47
0055656    1048.          NR20=(N50*100)/N49
0055706    1049.          NR21=(N52*100)/N51
0055746    1050.          NR22=(N54*100)/N53
0055775    1051.          NR23=(N56*100)/N55
0056038    1052.          NR24=(N58*100)/N57
0056066    1053.          NR25=(N60*100)/N59
0056126    1054.          NR26=(N62*100)/N61
0056156    1055.          NR27=(N64*100)/N63
0056216    1056.          MR=(M2*100)/M1
0056246    1057.          MR1=(M12*100)/M11
0056306    1058.          MR2=(M14*100)/M13
0056333    1059.          MR3=(M16*100)/M15
0056373    1060.          MR4=(M18*100)/M17
0056426    1061.          MR5=(M20*100)/M19
0056466    1062.          MR6=(M22*100)/M21
0056513    1063.          MR7=(M24*100)/M23
0056556    1064.          MR8=(M26*100)/M25
0056603    1065.          MR9=(M28*100)/M27
0056646    1066.          MR10=(M30*100)/M29
0056676    1067.          MR11=(M32*100)/M31
0056736    1068.          MR12=(M34*100)/M33
0056766    1069.          MR13=(M36*100)/M35
0057023    1070.          MR14=(M38*100)/M37
0057056    1071.          MR15=(M40*100)/M39
0057113    1072.          MR16=(M42*100)/M41
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0057145    1073.    MR17=(M44*100)/M43
0057206    1074.    MR18=(M46*100)/M45
0057238    1075.    MR19=(M48*100)/M47
0057278    1076.    MR20=(M50*100)/M49
0057328    1077.    MR21=(M52*100)/M51
0057368    1078.    MR22=(M54*100)/M53
0057418    1079.    MR23=(M56*100)/M55
0057456    1080.    MR24=(M58*100)/M57
0057508    1081.    MR25=(M60*100)/M59
0057546    1082.    MR26=(M62*100)/M61
J057576    1083.    MR27=(M64*100)/M63
0057636    1084.    LR=(L2*100)/L1
0057666    1085.    LR1=(L12*100)/L11
0057723    1086.    LR2=(L14*100)/L13
0057775    1087.    LR3=(L16*100)/L15
0060016    1088.    LR4=(L18*100)/L17
0060046    1089.    LR5=(L20*100)/L19
0060103    1090.    LR6=(L22*100)/L21
0060136    1091.    LR7=(L24*100)/L23
0060176    1092.    LR8=(L26*100)/L25
0060226    1093.    LR9=(L28*100)/L27
0060263    1094.    LR10=(L30*100)/L29
0060316    1095.    LR11=(L32*100)/L31
0060356    1096.    LR12=(L34*100)/L33
0060406    1097.    LR13=(L36*100)/L35
0060446    1098.    LR14=(L38*100)/L37
0060473    1099.    LR15=(L40*100)/L39
0060536    1100.    LR16=(L42*100)/L41
0060568    1101.    LR17=(L44*100)/L43
0060623    1102.    LR18=(L46*100)/L45
0060656    1103.    LR19=(L48*100)/L47
0060716    1104.    LR20=(L50*100)/L49
0060746    1105.    LR21=(L52*100)/L51
0061006    1106.    LR22=(L54*100)/L53
0061036    1107.    LR23=(L56*100)/L55
0061076    1108.    LR24=(L58*100)/L57
0061126    1109.    LR25=(L60*100)/L59
0061168    1110.    LR26=(L62*100)/L61
0061216    1111.    LR27=(L64*100)/L63
0061256    1112.    KR=(K2*100)/K1
0061306    1113.    KR1=(K12*100)/K11
0061346    1114.    KR2=(K14*100)/K13
0061373    1115.    KR3=(K16*100)/K15
0061436    1116.    KR4=(K18*100)/K17
0061468    1117.    KR5=(K20*100)/K19
006152c    1118.    KR6=(K22*100)/K21
0061556    1119.    KR7=(K24*100)/K23
0061616    1120.    KR8=(K26*100)/K25
0061646    1121.    KR9=(K28*100)/K27
0061703    1122.    KR10=(K30*100)/K29
0061736    1123.    KR11=(K32*100)/K31
0061776    1124.    KR12=(K34*100)/K33
0062026    1125.    KR13=(K36*100)/K35
0062066    1126.    KR14=(K38*100)/K37
0062116    1127.    KR15=(K40*100)/K39
0062156    1128.    KR16=(K42*100)/K41
0062206    1129.    KR17=(K44*100)/K43
0062246    1130.    KR18=(K46*100)/K45
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006227B    1131.        KR19=(K48*100)/K47
006233B    1132.        KR20=(K50*100)/K49
006236J    1133.        KR21=(K52*100)/K51
006242B    1134.        KR22=(K54*100)/K53
006245B    1135.        KR23=(K56*100)/K55
006251B    1136.        KR24=(K58*100)/K57
006254B    1137.        KR25=(K60*100)/K59
006260B    1138.        KR26=(K62*100)/K61
006263B    1139.        KR27=(K64*100)/K63
006267B    1140.        JR=(J2*100)/J1
006272B    1141.        JR1=(J12*100)/J11
006276B    1142.        JR2=(J14*100)/J13
006301J    1143.        JR3=(J16*100)/J15
006305B    1144.        JR4=(J18*100)/J17
006310B    1145.        JR5=(J20*100)/J19
006314J    1146.        JR6=(J22*100)/J21
006317B    1147.        JR7=(J24*100)/J23
006523B    1148.        JR8=(J26*100)/J25
006326J    1149.        JR9=(J28*100)/J27
006332B    1150.        JR10=(J30*100)/J29
006335B    1151.        JR11=(J32*100)/J31
006341J    1152.        JR12=(J34*100)/J33
006544B    1153.        JR13=(J36*100)/J35
006350B    1154.        JR14=(J38*100)/J37
006353B    1155.        JR15=(J40*100)/J39
006357B    1156.        JR16=(J42*100)/J41
006362J    1157.        JR17=(J44*100)/J43
006366B    1158.        JR18=(J46*100)/J45
006371B    1159.        JR19=(J48*100)/J47
006375J    1160.        JR20=(J50*100)/J49
006400B    1161.        JR21=(J52*100)/J51
006404J    1162.        JR22=(J54*100)/J53
006407B    1163.        JR23=(J56*100)/J55
006413J    1164.        JR24=(J58*100)/J57
006416B    1165.        JR25=(J60*100)/J59
006422B    1166.        JR26=(J62*100)/J61
006425J    1167.        JR27=(J64*100)/J63
006431J    1168.        NQ=((100)*(N2+M2+L2+K2+J2))/N
006440B    1169.        SUM=X+Y+Z+V+U
006444B    1170.        LL1=(100*(N18+M18+L18+K18+J18))/(N17+M17+L17+K17+J17)
006460B    1171.        LL2=(100*(N26+M26+L26+K26+J26))/(N25+M25+L25+K25+J25)
006474B    1172.        LL3=(100*(N34+M34+L34+K34+J34))/(N33+M33+L33+K33+J33)
006510B    1173.        LL4=(100*(N42+M42+L42+K42+J42))/(N41+M41+L41+K41+J41)
006524B    1174.        LL5=(100*(N50+M50+L50+K50+J50))/(N49+M49+L49+K49+J49)
006540B    1175.        LL6=(100*(N58+M58+L58+K58+J58))/(N57+M57+L57+K57+J57)
006554B    1176.        PRINT 827,SUM
006562J    1177.    827 FORMAT (//,* THE TOTAL PENALTY PAID THIS YEAR IS $*,F8.2)
006562B    1178.        PRINT 801,N
006567B    1179.    801 FORMAT (/////,5X,*THE TOTAL NUMBER OF CONTRACTS IS*,2X,I3)
006567B    1180.        PRINT 828,NQ
006574B    1181.    828 FORMAT (//,* THE PERCENTAGE OF CONTRACTS IN WHICH PENALTIES WERE P
                          CAID THIS YEAR IS*,2X,I3)
006574B    1182.        PRINT 802,N1,NR
006602B    1183.    802 FORMAT ( *1*,5X,*THE TOTAL NUMBER OF ROAD CONTRACTS FOR THE YEAR
                          CIS*,2X,I3,/,5X,*PERCENT OF ROAD CONTRACTS IN WHICH PENALTIES WERE
                          CPAID IS*,2X,I3)
006602B    1184.        PRINT 803,NR1,NR2,NR3
006611B    1185.    803 FORMAT (/////,5X,*PERCENT OF CITY ROAD CONTRACTS IN WHICH PENALTIES
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                    C WERE PAID IS*,2X,I3,/,5X,*PERCENT OF COUNTY ROAD CONTRACTS IN
                    CWHICH PENALTIES WERE PAID IS*,2X,I3,/,5X,*PERCENT OF STATE ROAD
                    CCONTRACTS IN WHICH PENALTIES WERE PAID IS*,2X,I3)
006611b   1186.        PRINT 804,N17,N25,N33,N41,N49,N57,NR4,NR8,NR12,NR16,NR20,NR24,
                    CN19,N27,N35,N43,N51,N59,NR5,NR9,NR13,NR17,NR21,NR25,N21,N29,
                    CN37,N45,N53,N61,NR6,NR10,NR14,NR18,NR22,NR26,N23,N31,N39,N47,
                    CN55,N63,NR7,NR11,NR15,NR19,NR23,NR27
006675b   1187.    804 FORMAT (/////,20X,*ROAD CONTRACTS FOR THE DISTRICTS*,//,29X,*01*,
                    C7X,*02*,7X,*03*,7X,*04*,7X,*05*,7X,*06*,/,* TOTAL NUMBER*,15X,
                    C I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* PERCENT WITH PENALTIES*,
                    C5X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH CITY EGR*,
                    C*7X,I3,6X,I3,6X,I3,6X,I3,5X,I3,6X,I3,/,* PERCENT PENALTY*CITY EGR*,
                    C3X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH COUNTY EGR*,
                    C5X,I3,6X,
                    CI3,6X,I3,6X,I3,6X,I3,/,* PERCENT PENALTY*COUNTY EGR*,1X, I3,
                    C6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH STATE EGR*,6X,I3,
                    C6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* PERCENT PENALTY*STATE EGR*,2X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3)
006675b   1188.        PRINT 805,X,X1,X2,X3
0067056   1189.    805 FORMAT (/////,5X,*TOTAL PENALTY FOR ROAD CONTRACTS IS*,2X,F8.2,
                    C/,5X,*TOTAL PENALTY FOR CITY ROAD CONTRACTS IS*,2X,F8.2,/,5X,
                    C*TOTAL PENALTY FOR COUNTY ROAD CONTRACTS IS*,2X,F8.2,/,5X,*TOTAL
                    C PENALTY FOR STATE ROAD CONTRACTS IS*,2X,F8.2)
0067056   1190.        PRINT 806,X5,X9,X13,X17,X21,X25,X6,X10,X14,X18,X22,X26,X7,X11,
                    CX15,X19,X23,X27
0067336   1191.    806 FORMAT (/////,28X,*PENALTY AMOUNTS*,//,19X,*01*,8*,*02*,8X,*03*,6X,
                    C*04*,8X,*05*,6X,*06*,/,* ROAD*CITY*,6X,F8.2,X,F8.2,X,F8.2,X,F8.2,
                    CF8.2,X,F8.2,//,* ROAD*COUNTY*,4X,F8.2,*,F8.2,X,F8.2,X,F8.2,X,
                    CF8.2,X,F8.2,//,* ROAD*STATE*,5X,F8.2,X,F8.2,X,F8.2,X,F8.2,X,F8.2,
                    CX,F8.2)
0067338   1192.        PRINT 807,M1,MR
006741B   1193.    807 FORMAT ( *1*,5X,*THE TOTAL NUMBER OF BRIDGE CONTRACTS FOR THE YEAR
                    C IS*,2X,I3,/,5X,*PERCENT OF BRIDGE CONTRACTS IN WHICH PENALTIES
                    C WERE PAID IS*,2X,I3)
0067418   1194.        PRINT 808,MR1,MR2,MR3
0067506   1195.    808 FORMAT (/////,5X,*PERCENT OF CITY BRIDGE CONTRACTS IN WHICH PENALTI
                    CES WERE PAID IS*,2X,I3,/,5X,*PERCENT OF COUNTY BRIDGE CONTRACTS IN
                    C WHICH PENALTIES WERE PAID IS*,2X,I3,/,5X,*PERCENT OF STATE BRIDGE
                    C CONTRACTS IN WHICH PENALTIES WERE PAID IS*,2X,I3)
0067508   1196.        PRINT 809,M17,M25,M33,M41,M49,M57,MR4,MR8,MR12,MR16,MR20,MR24,
                    CM19,M27,M35,M43,M51,M59,MR5,MR9,MR13,MR17,MR21,MR25,M21,M29,
                    CM37,M45,M53,M61,MR6,MR10,MR14,MR18,MR22,MR26,M23,M31,M39,M47,
                    CM55,MR7,MR11,MR15,MR19,MR23,MR27
0070348   1197.    809 FORMAT (/////,18X,*BRIDGE CONTRACTS FOR THE DISTRICTS*,//,29X,*01*,
                    C7X,*02*,7X,*03*,7X,*04*,7X,*05*,7X,*06*,/,* TOTAL NUMBER*,15X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* PERCENT WITH PENALTIES*,
                    C5X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH CITY EGR*,
                    C*7X,I3,6X,I3,6X,I3,6X,I3,5X,I3,6X,I3,/,* PERCENT PENALTY*CITY EGR*,
                    C3X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH COUNTY EGR*,
                    C5X,I3,6X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3,/,* PERCENT PENALTY*COUNTY EGR*,1X,I3,
                    C6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* NUMBER WITH STATE EGR*,6X,I3,
                    C6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,* PERCENT PENALTY*STATE EGR*,2X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3)
0070346   1198.        PRINT 810,Y,Y1,Y2,Y3
007044B   1199.    810 FORMAT (/////,5X,*TOTAL PENALTY FOR BRIDGE CONTRACTS IS*,2X,F8.2,
                    C/,5X,*TOTAL PENALTY FOR CITY BRIDGE CONTRACTS IS*,2X,F8.2,/,5X,
                    C*TOTAL PENALTY FOR COUNTY BRIDGE CONTRACTS IS*,2X,F8.2,/,5X,*TOTAL
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                      C PENALTY FOR STATE BRIDGE CONTRACTS IS#,2X,F8.2)
0070446    1200.          PRINT 811,Y5,Y9,Y13,Y17,Y21,Y25,Y6,Y10,Y14,Y18,Y22,Y26,Y7,Y11,
                      CY15,Y19,Y23,Y27
0070728    1201.      811 FORMAT (/////,28X,#PENALTY AMOUNTS#,//,22X,#01#,7X,#02#,6X,#03#,8X,
                      C#04#,6X,#05#,8X,#06#,//,# BRIDGE*CITY#,6X,F8.2,X,F8.2,X,F8.2,X,
                      CF8.2,X,F8.2,X,F8.2,//,# BRIDGE*COUNTY#,4X,F8.2,X,F8.2,X,F8.2,X,
                      CF8.2,X,F8.2,X,F8.2,//,# BRIDGE*STATE#,5X,F8.2,X,F8.2,X,F8.2,X,
                      CF8.2,X,F8.2,X,F8.2)
007072C    1202.          PRINT 812, L1,LR
0071006    1203.      812 FORMAT ( #1#,5X,#THE TOTAL NUMBER OF ROAD*TRAFFIC CONTRACTS FOR TH
                      CE YEAR IS#,2X,I3,/,5X,#PERCENT OF ROAD*TRAFFIC CONTRACTS IN WHICH
                      CPENALTIES WERE PAID IS#,2X,I3)
0071006    1204.          PRINT 813,LR1,LR2,LR3
007107b    1205.      813 FORMAT (/////,5X,#PERCENT OF CITY ROAD*TRAFFIC CONTRACTS IN WHICH P
                      CENALTIES WERE PAID IS#,2X,I3,/,5X,#PERCENT OF COUNTY ROAD*TRAFFIC
                      CCONTRACTS IN WHICH PENALTIES WERE PAID IS#,2X,I3,/,5X,#PERCENT OF
                      CSTATE ROAD*TRAFFIC CONTRACTS IN WHICH PENALTIES WERE PAID IS#,2X,
                      CI3)
007107b    1206.          PRINT 814,L17,L25,L33,L41,L49,L57,LR4,LR8,LR12,LR16,LR20,LR24,
                      CL19,L27,L35,L43,L51,L59,LR5,LR9,LR13,LR17,LR21,LR25,L21,L29,
                      CL37,L45,L53,L61,LR6,LR10,LR14,LR18,LR22,LR26,L23,L31,L39,L47,
                      CL55,L63,LR7,LR11,LR15,LR19,LR23,LR27
007173b    1207.      814 FORMAT (/////,18X,#ROAD TRAFFIC CONTRACTS FOR THE DISTRICTS#,//,29X
                      C,#01#,7X,#02#,7X,#03#,7X,#04#,7X,#05#,7X,#06#,/,# TOTAL NUMBER#,15
                      CX,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT WITH PENALTIES#,5X,
                      CI3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH CITY EGR#,7X,I3,6
                      CX,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*CITY EGR#,3X,I3,6
                      CX,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH COUNTY EGR#,5X,I3,6X,
                      CI3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*COUNTY EGR#,1X,I3,6
                      CX,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH STATE EGR#,6X,I3,6X,I
                      C3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*STATE EGR#,2X,I3,6X,
                      CI3,6X,I3,6X,I3,6X,I3,6X,I3)
0071735    1208.          PRINT 815,Z,Z1,Z2,Z3
007203B    1209.      815 FORMAT (/////,5X,#TOTAL PENALTY FOR ROAD*TRAFFIC CONTRACTS IS#,2X,F
                      C8.2,/,5X,#TOTAL PENALTY FOR CITY ROAD*TRAFFIC CONTRACTS IS#,2X,F8.
                      C2,/,5X,#TOTAL PENALTY FOR COUNTY ROAD*TRAFFIC CONTRACTS IS#,2X,F8.
                      C2,/,5X,#TOTAL PENALTY FOR STATE ROAD*TRAFFIC CONTRACTS IS#,2X,F8.2
                      C)
007203b    1210.          PRINT 816,Z5,Z9,Z13,Z17,Z21,Z25,Z6,Z10,Z14,Z18,Z22,Z26,Z7,Z11,
                      C215,Z19,Z23,Z27
0072318    1211.      816 FORMAT (/////,28X,#PENALTY AMOUNTS#,//,27X,#01#,8X,#02#,8X,#03#,5X,
                      C#04#,8X,#05#,8X,#06#,//,# ROAD*TRAFFIC*CITY#,5X,F8.2,X,F8.2,X,F8.2,
                      CX,F8.2,X,F8.2,X,F8.2,//,# ROAD*TRAFFIC*COUNTY#,4X,F8.2,X,F8.2,X,F8
                      C.2,X,F8.2,X,F8.2,X,F8.2,//,# ROAD*TRAFFIC*STATE#,5X,F8.2,X,F8.2,X,
                      CF8.2,X,F8.2,X,F8.2)
0072316    1212.          PRINT 817,K1,KR
0072376    1213.      817 FORMAT ( #1#,5X,#THE TOTAL NUMBER OF ROAD*SURFACING CONTRACTS FOR
                      CTHE YEAR IS#,2X,I3,/,5X,#PERCENT OF ROAD*SURFACING CONTRACTS IN WH
                      CICH PENALTIES WERE PAID IS#,2X,I3)
0072376    1214.          PRINT 818,KR1,KR2,KR3
0072463    1215.      818 FORMAT (/////,5X,#PERCENT OF CITY ROAD*SURFACING CONTRACTS IN WHICH
                      C PENALTIES WERE PAID IS#,2X,I3,/,5X,#PERCENT OF COUNTY ROAD*SURFAC
                      CING CONTRACTS IN WHICH PENALTIES WERE PAID IS#,2X,I3,/,5X,#PERCENT
                      C OF STATE ROAD*SURFACING CONTRACTS IN WHICH PENALTIES WERE PAID IS
                      C#,2X,I3)
0072466    1216.          PRINT 819,K17,K25,K33,K41,K49,K57,KR4,KR8,KR12,KR16,KR20,KR24,
                      CK19,K27,K35,K43,K51,K59,KR5,KR9,KR13,KR17,KR21,KR25,K21,K23,
                      CK37,K45,K53,K61,KR6,KR10,KR14,KR18,KR22,KR26,K23,K31,K39,K47,
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                         CK55,K53,KR7,KR11,KM15,KR19,KR23,KR27
0073320    1217.    819 FORMAT (/////,18X,#ROAD*SURFACING CONTRACTS FOR THE DISTRICTS#,//,#
                    C9X,#01#,7X,#02#,7X,#J3#,7X,#04#,7X,#05#,7X,#06#,/,# TOTAL NUMBER#,
                    C15X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT WITH PENALTIES#,5
                    CX,I3,5X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH CITY EGR#,7X,I3
                    C,6X,I3,5X,I3,5X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*CITY EGR#,3X,I3
                    C,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH COUNTY*EGR#,2X,I3,6
                    CX,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*COUNTY EGR#,1X,I3
                    C,6X,I3,6X,I3,6X, I3,6X,I3,6X,I3,/,# NUMBER WITH STATE EGR#,6X,I3,6X
                    C,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*STATE EGR#,2X,I3,6
                    CX,I3,6X,I3,6X,I3,6X,I3,6X,I3)
0073326    1218.        PRINT 820,V,V1,V2,V3
0073425    1219.    820 FORMAT (/////,5X,#TOTAL PENALTY FOR ROAD*SURFACING CONTRACTS IS#,2X
                    C,F8.2,/,5X,#TOTAL PENALTY FOR CITY ROAD*SURFACING CONTRACTS IS#,2X
                    C,F8.2,/,5X,#TOTAL PENALTY FOR COUNTY ROAD*SURFACING CONTRACTS IS#,
                    C2X,F8.2,/,5X,#TOTAL PENALTY FOR STATE ROAD*SURFACING CONTRACTS IS#
                    C,2X,F8.2)
0073426    1220.        PRINT 821,V5,V9,V13,V17,V21,V25,V6,V10,V14,V18,V22,V26,V7,V11,
                    CV15,V19,V23,V27
0073706    1221.    821 FORMAT (/////,28X,#PENALTY AMOUNTS#,//,30X,#01#,7X,#02#,6X,#03#,6X,
                    C#04#,7X,#05#,7X,#06#,//,# ROAD*SURFACING*CITY#,5X,F8.2,X,F8.2,X,F8.
                    C2,X,F8.2,X,F8.2,X,F 8.2,//,# ROAD*SURFACING*COUNTY#,4X,F8.2,X,F8.2,
                    CX,F8.2,X,F8.2,X,F8.2,X,F8.2,//,# ROAD*SURFACING*STATE#,5X,F8.2,X,F
                    C8.2,X,F8.2,X,F8.2,X,F8.2)
0073705    1222.        PRINT 822,J1,JR
0073766    1223.    822 FORMAT ( #1#,5X,#THE TOTAL NUMBER OF ROAD*MAINTENANCE CONTRACTS FU
                    CR THE YEAR IS#,2X,I3,/,5X,#PERCENT OF ROAD*MAINTENANCE CONTRACTS I
                    CN WHICH PENALTIES WERE PAID IS#,2X,I3)
0073766    1224.        PRINT 823,JR1,JR2,JR3
0074053    1225.    823 FORMAT (/////,5X,#PERCENT OF CITY ROAD*MAINTENANCE CONTRACTS IN WHI
                    CCH PENALTIES WERE PAID IS#,2X,I3,/,5X,#PERCENT OF COUNTY ROAD*MAIN
                    CTENANCE CONTRACTS IN WHICH PENALTIES WERE PAID IS#,2X,I3,/,5X,#PER
                    CCENT OF STATE ROAD*MAINTENANCE CONTRACTS IN WHICH PENALTIES WERE P
                    CAID IS#,2X,I3)
0074056    1226.        PRINT 824,J17,J25,J33,J41,J49,J57,JR4,JR8,JR12,JR16,JR20,JR24,
                    CJ19,J27,J35,J43,J51,J59,JR5,JR9,JR13,JR17,JR21,JR25,J21,J29,
                    CJ37,J45,J53,J61,JR6,JR10,JR14,JR18,JR22,JR26,J23,J31,J39,J47,
                    CJ55,J63,JR7,JR11,JR15,JR19,JR23,JR27
0074710    1227.    824 FORMAT (/////,18X,#ROAD*MAINTENANCE CONTRACTS FOR THE DISTRICTS#,//
                    C,29X,#01#,7X,#02#,7X,#03#,7X,#04#,7X,#05#,7X,#06#,/,# TOTAL NUMBER
                    C#,15X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT WITH PENALTIES#
                    C,5X,I3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH CITY EGR#,7X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*CITY FGR#,3X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH COUNTY EGR#,5X,I3
                    C,6X,I3,6X,I3,6X, I3,6X,I3,6X,I3,/,# PERCENT PENALTY*COUNTY EGR#,1X,
                    CI3,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# NUMBER WITH STATE EGR#,6X,I3,
                    C6X,I3,6X,I3,6X,I3,6X,I3,6X,I3,/,# PERCENT PENALTY*STATE FGR#,2X,I3
                    C,6X,I3,6X,I3,6X,I3,6X,I3,6X,I3)
0074716    1228.        PRINT 825,U,U1,U2,U3
0075010E   1229.    825 FORMAT (/////,5X,#TOTAL PENALTY FOR ROAD*MAINTENANCE CONTRACTS IS#,
                    C2X,F8.2,/,5X,#TOTAL PENALTY FOR CITY ROAD*MAINTENANCE CONTRACTS IS
                    C#,2X,F8.2,/,5X,#TOTAL PENALTY FOR COUNTY ROAD*MAINTENANCE CONTRACT
                    CS IS#,2X,F8.2,/,5X,#TOTAL PENALTY FOR STATE ROAD*MAINTENANCE CONTR
                    CACTS IS#,2X,F8.2)
0075016    1230.        PRINT 826,J5,J9,U13,J17,U21,U25,U6,U10,U14,U18,U22,U26,U7,J11,
                    CU15,U19,U23,U27
0075276    1231.    826 FORMAT (/////,28X,#PENALTY AMOUNTS#,//,30X,#01#,8X,#02#,8X,#03#,7X,
                    C#04#,7X,#05#,7X,#06#,//,# ROAD*MAINTENANCE*CITY#,6X,F8.2,X,F8.2,X,F
```

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                   C8.2,X,F8.2,X,F8.2,X,F8.2,//,# ROAD*MAINTENANCE*COUNTY#,4X,F8.2,X,F
                   C8.2,X,F9.2,X,F8.2,X,F8.2,X,F8.2,//,# ROAD*MAINTENANCE*STATE#,5X,F8
                   C.2,X,F8.2,X,F8.2,X,F8.2,X,F8.2X,F8.2)
0075276   1232.        PRINT 829,LL1,LL2,LL3,LL4,LL5,LL6
0075416   1233.    829 FORMAT ( #1#,5X,#OVERALL PENALTY PERCENTAGE BREAKDOWN BY DISTRICTS
                   C#,//,5X,#01#,5X,#02#,5X,#03#,5X,#04#,5X,#05#,5X,#06#,//4X,I3,4X,I3
                   C,4X,I3,4X,I3,4X,I3,4X,I3)
0075416   1234.        STOP
007543E   1235.        END
                C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
                C
                C*  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
                              ANALYSIS FOR 1975
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Appendix B

Appendix B

COMPUTER PROGRAM OUTPUT

CONTRACTS WITH PENALTIES	PENALTY AMOUNT
R*08744	1231.53
R*08937	1979.34
R*08955	712.25
R*09060	287.04
R*09209	74.12
R*09440	274.23
R*09553	314.46
R*09581	65.60
R*09586	610.46
R*09621	70.33
R*09732	794.02
R*09831	372.08
R*09875	380.60
R*09878	381.23
R*09879	43.78
R*09906	55.16
R*09930	62.02
R*10092	181.64
R*10198	129.81
R*10246	22.43
R*09543	532.03
R*09568	1068.71
R*09427	822.22
R*09357	95.30
R*10127	19.84
R*09888	138.49
R*09880	162.21
R*09356	166.69
R*10090	22.06
R*09971	24.28

R*09762	24.82
R*09766	196.18
R*09505	699.68
B*09912	24.72
B*09514	327.18
B*09820	39.71
B*08840	49.69
B*09941	34.04
B*10131	154.18
B*09925	53.63
B*09750	879.43
B*09486	72.07
B*09377	12.82
B*08836	360.55
B*08877	6245.05
B*09954	23.09
B*09488	22.23
B*09425	275.14
B*09866	97.22
B*09755	376.93
B*09658	17.29
B*09660	38.27
RT*09897	15.60
RT*10163	19.88
RT*09695	403.23
TX*09433	1896.96
TX*09432	2536.52
TX*09367	1474.72
TX*09074	773.51
RT*10239	26.20

RT*09841	69.81
RT*09834	1589.00
RT*09833	684.90
RS*10055	15.16
RS*10056	26.14
RS*09990	42.77
RS*09992	25.75
RS*10175	12.90
RS*10047	328.40
RS*09982	56.73
RS*10044	665.24
RS*09807	149.38
RM*10038	271.89
RM*10039	47.45
RM*10037	22.73

THE TOTAL PENALTY PAID THIS YEAR IS $32272.57

THE TOTAL NUMBER OF CONTRACTS IS 355

THE PERCENTAGE OF CONTRACTS IN WHICH PENALTIES WERE PAID THIS YEAR IS 21

THE TOTAL NUMBER OF ROAD CONTRACTS FOR THE YEAR IS   34
PERCENT OF ROAD CONTRACTS IN WHICH PENALTIES WERE PAID IS   35

PERCENT OF CITY ROAD CONTRACTS IN WHICH PENALTIES WERE PAID IS   54
PERCENT OF COUNTY ROAD CONTRACTS IN   WHICH PENALTIES WERE PAID IS   33
PERCENT OF STATE ROAD   CONTRACTS IN WHICH PENALTIES WERE PAID IS   32

ROAD CONTRACTS FOR THE DISTRICTS

	01	02	03	04	05	06
TOTAL NUMBER	13	15	13	14	22	17
PERCENT WITH PENALTIES	38	26	69	21	31	29
NUMBER WITH CITY EGR	1	4	2	3	1	0
PERCENT PENALTY*CITY EGR	100	50	100	33	0	0
NUMBER WITH COUNTY EGR	0	1	1	0	1	0
PERCENT PENALTY*COUNTY EGR	0	0	100	0	0	0
NUMBER WITH STATE EGR	12	10	10	11	20	17
PERCENT PENALTY*STATE EGR	33	20	60	18	35	29

TOTAL PENALTY FOR ROAD CONTRACTS IS   12014.46
TOTAL PENALTY FOR CITY ROAD CONTRACTS IS   1511.29
TOTAL PENALTY FOR COUNTY ROAD CONTRACTS IS   55.16
TOTAL   PENALTY FOR STATE ROAD CONTRACTS IS   10448.01

PENALTY AMOUNTS

	01	02	03	04	05	06
ROAD*CITY	22.06	300.70	1166.10	22.43	0	0
ROAD*COUNTY	0	0	55.16	0	0	0
ROAD*STATE	944.96	186.53	2943.39	561.27	4517.27	1294.59

THE TOTAL NUMBER OF BRIDGE CONTRACTS FOR THE YEAR IS 107
PERCENT OF BRIDGE CONTRACTS IN WHICH PENALTIES   WERE PAID IS   17

PERCENT OF CITY BRIDGE CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF COUNTY BRIDGE CONTRACTS IN WHICH PENALTIES WERE PAID IS   21
PERCENT OF STATE BRIDGE CONTRACTS IN WHICH PENALTIES WERE PAID IS   17

BRIDGE CONTRACTS FOR THE DISTRICTS

	D1	D2	D3	D4	D5	D6
TOTAL NUMBER	11	24	15	23	17	17
PERCENT WITH PENALTIES	36	12	46	4	11	11
NUMBER WITH CITY EGR	0	0	0	0	0	0
PERCENT PENALTY*CITY EGR	0	0	0	0	0	0
NUMBER WITH COUNTY EGR	5	5	1	1	5	2
PERCENT PENALTY*COUNTY EGR	40	20	100	0	0	0
NUMBER WITH STATE EGR	6	19	14	22	12	15
PERCENT PENALTY*STATE EGR	33	10	42	4	16	13

TOTAL PENALTY FOR BRIDGE CONTRACTS IS   9103.24
TOTAL PENALTY FOR CITY BRIDGE CONTRACTS IS   0
TOTAL PENALTY FOR COUNTY BRIDGE CONTRACTS IS   229.79
TOTAL PENALTY FOR STATE BRIDGE CONTRACTS IS   8873.45

PENALTY AMOUNTS

	D1	D2	D3	D4	D5	D6
BRIDGE*CITY	0	0	0	0	0	0
BRIDGE*COUNTY	135.49	22.23	72.07	0	0	0
BRIDGE*STATE	394.22	298.23	7705.66	34.04	89.40	351.90

THE TOTAL NUMBER OF ROAD*TRAFFIC CONTRACTS FOR THE YEAR IS   36
PERCENT OF ROAD*TRAFFIC CONTRACTS IN WHICH PENALTIES WERE PAID IS   30

PERCENT OF CITY ROAD*TRAFFIC CONTRACTS IN WHICH PENALTIES WERE PAID IS   72
PERCENT OF COUNTY ROAD*TRAFFIC CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF STATE ROAD*TRAFFIC CONTRACTS IN WHICH PENALTIES WERE PAID IS   12

ROAD*TRAFFIC CONTRACTS FOR THE DISTRICTS

	01	02	03	04	05	06
TOTAL NUMBER	4	3	12	8	4	5
PERCENT WITH PENALTIES	25	100	50	12	0	0
NUMBER WITH CITY EGR	2	2	4	2	1	0
PERCENT PENALTY*CITY EGR	50	100	100	50	0	0
NUMBER WITH COUNTY EGR	0	0	0	0	0	0
PERCENT PENALTY*COUNTY EGR	0	0	0	0	0	0
NUMBER WITH STATE EGR	2	1	8	6	3	5
PERCENT PENALTY*STATE EGR	0	100	25	0	0	0

TOTAL PENALTY FOR ROAD*TRAFFIC CONTRACTS IS   9490.33
TOTAL PENALTY FOR CITY ROAD*TRAFFIC CONTRACTS IS   7547.29
TOTAL PENALTY FOR COUNTY ROAD*TRAFFIC CONTRACTS IS   0
TOTAL PENALTY FOR STATE ROAD*TRAFFIC CONTRACTS IS   1943.04

PENALTY AMOUNTS

	01	02	03	04	05	06
ROAD*TRAFFIC*CITY	684.90	1658.81	5187.98	15.60	0	0
ROAD*TRAFFIC*COUNTY	0	0	0	0	0	0
ROAD*TRAFFIC*STATE	0	26.20	1916.84	0	0	0

THE TOTAL NUMBER UF ROAD*SURFACING CONTRACTS FOR THE YEAR IS   75
PERCENT OF ROAD*SURFACING CONTRACTS IN WHICH PENALTIES WERE PAID IS   11

PERCENT OF CITY ROAD*SURFACING CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF COUNTY ROAD*SURFACING CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF STATE ROAD*SURFACING CONTRACTS IN WHICH PENALTIES WERE PAID IS   11

ROAD*SURFACING CONTRACTS FOR THE DISTRICTS

	01	02	03	04	05	06
TOTAL NUMBER	13	12	8	13	14	16
PERCENT WITH PENALTIES	15	25	0	23	7	0
NUMBER WITH CITY EGR	0	0	0	0	0	0
PERCENT PENALTY*CITY EGR	0	0	0	0	0	0
NUMBER WITH COUNTY*EGR	0	0	0	0	0	0
PERCENT PENALTY*COUNTY EGR	0	0	0	0	0	0
NUMBER WITH STATE EGR	13	12	8	13	14	16
PERCENT PENALTY*STATE EGR	15	25	0	23	7	0

TOTAL PENALTY FOR ROAD*SURFACING CONTRACTS IS   1322.47
TOTAL PENALTY FOR CITY ROAD*SURFACING CONTRACTS IS   0
TOTAL PENALTY FOR COUNTY ROAD*SURFACING CONTRACTS IS   0
TOTAL PENALTY FOR STATE ROAD*SURFACING CONTRACTS IS   1322.47

PENALTY AMOUNTS

	01	02	03	04	05	06
ROAD*SURFACING*CITY	0	0	0	0	0	0
ROAD*SURFACING*COUNTY	0	0	0	0	0	0
ROAD*SURFACING*STATE	814.62	398.03	0	94.66	15.16	0

THE TOTAL NUMBER OF ROAD*MAINTENANCE CONTRACTS FOR THE YEAR IS   42
PERCENT OF ROAD*MAINTENANCE CONTRACTS IN WHICH PENALTIES WERE PAID IS   7

PERCENT OF CITY ROAD*MAINTENANCE CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF COUNTY ROAD*MAINTENANCE CONTRACTS IN WHICH PENALTIES WERE PAID IS   0
PERCENT OF STATE ROAD*MAINTENANCE CONTRACTS IN WHICH PENALTIES WERE PAID IS   7

ROAD*MAINTENANCE CONTRACTS FOR THE DISTRICTS

	01	02	03	04	05	06
TOTAL NUMBER	2	6	9	7	8	10
PERCENT WITH PENALTIES	0	16	22	0	0	0
NUMBER WITH CITY EGR	0	0	0	0	0	0
PERCENT PENALTY*CITY EGR	0	0	0	0	0	0
NUMBER WITH COUNTY EGR	0	0	0	0	0	0
PERCENT PENALTY*COUNTY EGR	0	0	0	0	0	0
NUMBER WITH STATE EGR	2	6	9	7	8	10
PERCENT PENALTY*STATE EGR	0	16	22	0	0	0

TOTAL PENALTY FOR ROAD*MAINTENANCE CONTRACTS IS   342.07
TOTAL PENALTY FOR CITY ROAD*MAINTENANCE CONTRACTS IS   0
TOTAL PENALTY FOR COUNTY ROAD*MAINTENANCE CONTRACTS IS   0
TOTAL PENALTY FOR STATE ROAD*MAINTENANCE CONTRACTS IS   342.07

PENALTY AMOUNTS

	01	02	03	04	05	06
ROAD*MAINTENANCE*CITY	0	0	0	0	0	0
ROAD*MAINTENANCE*COUNTY	0	0	0	0	0	0
ROAD*MAINTENANCE*STATE	0	22.73	319.34	0	0	0

OVERALL PENALTY PERCENTAGE BREAKDOWN BY DISTRICTS

D1	D2	D3	D4	D5	D6
27	23	42	12	15	10

Appendix C

Appendix C

ERRATA SHEETS FOR THE <u>INDIANA STATE HIGHWAY COMMISSION 1970 CONSTRUCTION</u>

<u>RECORD GUIDE FOR ROAD, BRIDGE, MAINTENANCE, AND TRAFFIC CONTRACTS</u>

Explanation Sheet 1b	Quantity in the first paragraph is misspelled.
Page 1-1	In the volume of cut column, the 118 should be 119.
Page 1A-1	In the % deviation column, the 0 for Station 7 should be +1. The algebraic total should be +13. The average should be +1.
Page 1A-2	The quantity on plans should be 98766. The difference should be -129.
Page 3	The quantity placed should be 20243. The overrun quantity should be 4846. The overrun cost should be $2907.60.
Page 3-1	The sum of end areas for stations 33+00 and 33+50 should be 1871. The volume of cut for these stations should be 1732. The total cut should be 20243.
Explanation Sheet 6a	In the second paragraph, if in the last line is misspelled.
Page 6	For structure number 16, the remarks column should read "See p. 70."
Page 6-1	On the bottom drawing, the 4.5' measurement should be 3.0'. A new dimension should be added to show 1.5' of cover. Beside the bottom drawing, both lines should read "from table 006."
Page 6-2	The line below the drawing should read "From Table 003."

Page 7-1	In the summary, the curb and gutter removal should be item 9. In the heading, the contract number should be I-0000 and the item number should be 7 & 9.
Page 11-1	For day 19, the lineal feet laid should be 1060. For day 22, the lineal feet laid should be 700.
Page 14-1	For day 17, the lineal feet laid should be 5100. For day 18, the lineal feet laid should be 5100. For day 29, the lineal feet laid should be 10200.
Page 16-1	For the first course, the lineal feet laid should be 1530. This is also true for the second and third courses.
Page 17-2	The top 10 feet of the sketch should be labeled H.
Page 28-2	Between stations 50+00 and 52+80, the average depth should be 4.25.
Page 31-1	The bottom toewall calculation should total to 122.8. The sum of the toewall areas will then be 148.8. The grand total area above the summary block should be 380.8.
Page 41-1	In both road portion calculations, the weight should be 2237 and not 2230.
Page 53-2	The total of the length put in leads column should be 314.1.
Page 59	The last line should read "on I.C. 626 on p. 73."
Page 61	After the last line, add "Addition approved on I.C. 626 on p. 73."
Page 62	In the second to the last line, maintenance is misspelled.
Page 63-3	The peat excavation unit price should be $0.60. The peat excavation quantity increase should be 4846.

Page 63-3 cont'd.	The peat excavation amount increase should be $2907.60. The peat excavation % change should be +31%. The total amount increase should be $68615.00. The total estimated cost should be $15242.00. In the top paragraph, the fourth line should read "sheet 63-4."
Page 63-4	For peat excavation, the final quantity should be 20243. For peat excavation, the overrun should be 4846.
Page 65-1	The % of change for item 17 should be -9%.
Page 65-2	In the middle of the page, the statement should read "To pps. 17-1 & 65-1."
Page 66	The specification article referred to should be 715.12.
Page 66-1	The specification article referred to should be 715.12.
Page 70	For structure 14, the error in plan quantity should be +30. For structure 14, the net change regular portion should be +23. Item 6 quantity increase should be 23. Item 6 amount increase should be $92.00. Total increase amount should be $92.00. The estimated cost should be $28.00.
Page 71	The first line in the second paragraph should read "on sheet 10-3." At the bottom of the table, does and decreased should be marked out.
Page 72	The last line of the paragraph should read "Extra Work Agreement on p. 67-1."
Page 74	For item 3, the final estimate quantity should be 20243. For item 3, the final estimate amount should be $12145.80. For item 3, the overrun quantity should be 4846. For item 3, the overrun amount should be $2907.60.

Page 77

The final estimate amount should be
$475911.79.
The overrun amount should be $86157.84.
The net overrun should be $22478.29.
The net overrun percentage should be 4.957%.

Page 78

For item 3, the final estimate quantity
should be 20243.
For item 3, the final estimate amount
should be $12145.80.
For item 3, the overrun quantity should
be 4846.
For item 3, the overrun amount should
be $2907.60.

Page 80

The total original estimate amount
should be $405541.85.
The total final estimate amount should
be $425947.74.
The overrun total amount should be
$83361.44.
The net overrun should be $20405.89.
The net overrun percentage should
be 5.032%.

Table 107

For D=1.8, V=0.0659.

Index

Accuracy misspelled on lines 3 and 4
of the first page.
Surface misspelled on line 20 of the
first page.
Theoretical misspelled on lines 22 and
23 of the third page.